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UNITED STATES ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts

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July 30, 1948

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Errata

It was erroneously indicated in Volume I, Volume 2 of Nuclear Science Abstracts, that the documents corresponding with the following abstracts would be for sale by the Atomic Energy Commission:

Abstracts Numbers 269, 299, 300, 301, 306 and 335.

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NUCLEAR SCIENCE ABSTRACTS

Volume I Number 2

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ABSORPTION AND SCATTERING OF RADIATION

220 Angular Distribution; Gamma-Quanta Which are Formed in the Annihilation of Positrons, by N. A. Vlasov and E. A. Tsirel'son. Doklady Akademii Nauk SSSR 59, p. 879, February 1948.

221 Approximation Method for Calculating Diffusion of Resonance Radiation, by L. Biberman. Doklady Akademii Nauk SSSR 59, p. 659, February 1948.

222 Equation for Scattering of Particles, Taking into Account Reaction of Emission, by D. Blokhintzev. Doklady Akademii Nauk SSSR 53, p. 201-204, 1946.

Taking into account the reaction of scattered waves, an equation for the scattering of particles is derived by the method of stationary states. A continuous spectrum is assumed.

223 An Excited State of Be^9 by Inelastic Scattering of Protons, by K. E. Davis and E. M. Hafner. Physical Review 73, p. 1473, June 15, 1948.

The spectrum of protons emitted in the reaction $Be^9(p,p')Be^9$ has been studied in order to locate low lying excited states of Be^9 in the region 0-5.2 Mev. The results indicate no bound states above the ground state, a virtual state at 2.41 Mev (0.78 Mev above the dissociation energy), and no other states up to about 5.2 Mev. The cross section for excitation of the level is about 3×10^{-27} cm^2 at these energies. The experimental width is not significantly greater than the width of the elastic peak, suggesting an actual width less than 0.10 Mev. Calculations based on the Be^9 model used by Caldirola (Nuovo Ciminti 4, p. 39, 1947) account for this state in a qualitative way, giving a value for the position which is in approximate agreement with the experimental results.

224 The Relation of Backscattering to Self-Absorption in Routine Beta-Ray Measurements, by P. E. Yankwich and John W. Weigl. Science 107, p. 651-653, June 1948. (See also MDDC-1739)

The effects of backscattering upon self-absorption correction curves are demonstrated. Data are given for the backscattering powers of several substances, for the beta radiation from C^{14}, and for self-absorption of samples of barium carbonate and wax, containing C^{14}, mounted on aluminum. A more refined treatment of the problem is being worked on.

225 Single Scattering and Annihilation of Fast Positrons, by W. Bothe and Ho Zah-Wei. Nachrichten von der Gesellschaft der Wissenschaften zu Göttingen, p. 59-61, 1946.

(Cont'd on next page)

ABSORPTION AND SCATTERING OF RADIATION

(Cont't from preceding page)

Cloud chamber experiments were made to investigate the collision between positrons and electrons from Mn^{52}. The energy and impulse law holds for all collisions. The statistics of the relative energy loss of the positron are considered. Satisfactory agreement was found between the calculated and observed frequency-distributions. The annihilation of the positron is theoretically rare. Three cases of it were noted with particles of energies 92, 245, and 352 Kev, respectively. Collisions between positrons and nuclei resulting in considerable deflexion are considered. Relatively large energy losses result; a possible explanation is the formation of a neutrino-pair.

ATOMIC POWER

226 Atomic Energy 1948. Business Week p. 47-54, April 10, 1948.

This is a report on the present status of atomic energy for war and peace.

227 Behind Our Atomic Iron Curtain Big-Scale Construction Goes On, by Robert Colborn. Engineering News Record 140, p. 68-72, April 15, 1948

A review of atomic energy operations is presented. Consideration is given to the probable magnitude of construction work required for the present program and observations are made as to probable future developments.

228 Nuclear Engineering, by J. R. Huffman. Mechanical World 123(3198), p. 483-487 April 30, 1948. (See also Guide to Published Research 3, Abstracts 238 and 837; see also MDDC-1302).

The scope of nuclear engineering might be defined as the design, construction, and operation of nuclear reactors to produce power or useful radioisotopes, or radiochemical plants to recover the fuel or the by-products, and of waste storage and disposal systems. This paper attempts to establish the basic principles of nuclear engineering by presenting some of the new concepts and outlining the magnitude of the design problems. Inasmuch as nuclear engineering is still closely allied to physics and radio-chemistry, the presentation leans toward fundamental principles rather than strict engineering practice. Nucleonics, new concepts, terms, cooling fluids, design attack, health hazards, and disposal of waste are all discussed. This new field is recommended as one of the most challenging and fascinating which has developed in the past two decades. (TDD)

BIOLOGICAL EFFECTS OF RADIATION

229 **Induced Reversions of Biochemical Mutants in Neurospora Crassa, by N. H. Giles, Jr. AECD-2068, n.d., decl. December 8, 1947. 10 p. Document for sale by AEC. (Presented at 1947 meeting of the Genetics Society of America, Chicago, December 1947. See also Genetics 33, p. 105, January 1948.)**

Studies have been made of the effects of mutagenic agents in inducing adaptations of a number of biochemical mutants in Neurospora crassa. The frequency of adaptation of certain mutants, such as inositolless (Stanford mutant number 37401), cholineless (34486), methionineless (4894), and riboflavinless (51602) can be greatly increased by ultraviolet radiation; for other mutants, such as pantothenicless (5531), no adaptations have been produced by any treatment yet attempted. Genetic and physiological tests, particularly with the inositolless mutant (37401), indicate that these induced adaptations represent reverse mutations to the original wild type allele. X-rays, radiophosphorus, and nitrogen mustard have also proved effective in inducing reversions of inositolless (37401). The frequency of reverse mutation has been demonstrated to be a function of the radiation dose (with ultraviolet treatment) for the inositolless mutant 37401 by utilizing a plating colony-count technique made possible with a multiple biochemical-colonial mutant (colonial-inositolless-pantothenicless-albino 2). Preliminary comparative studies of the frequencies of induced reversions in six independently produced, allelic, inositolless mutants indicate that some of these strains differ markedly in their mutability. Such differences suggest that, even though the inositolless loci in these strains behave as alleles, the induced genetic changes resulting in the inositolless phenotype are probably not identical in all six mutants.

230 **Some Effects on Embryo and Young Rainbow Trout (Salmo Gairdnerii Richardson) from Exposing the Parent Fish to X-Rays, by R. F. Foster. AECD-2079 (UWFL-12), 1948, decl. June 24, 1948. 110 p. Document for sale by AEC. (To be used as a thesis requirement for a Doctor of Philosophy degree)**

This document is a thesis.

One hundred and forty-eight rainbow trout approximately twenty months old and approaching sexual maturity were divided into a control group and seven irradiated groups. Total body irradiation doses of 50 r, 100 r, 500 r, 750 r, 1000 r, 1500 r, and 2500 r were administered at a distance of 48 inches from the target of the X-ray tube, using 200 kilovolts and 20 milliamperes and filters of 0.5 millimeter of copper and 1.0 millimeter of aluminum. The average radiation intensity received by the fish was 8.25 r per minute. When the fish became mature about three months after irradiation, they were spawned and a total of 115,454 eggs were obtained from 67 females.

The gametogenesis, egg development, abnormalities, fry mortality, early fingerling mortality, and growth of the fish are discussed at length and the results are tabulated.

Photographs of apparatus used and development stages are furnished. Included are a series of photographs showing: the stages of development of the rainbow trout eggs; the abnormal trout eggs from parents exposed to various doses of X-radiation; abnormal rainbow trout embryos reaching various stages of development; and common types of abnormal fry found among rainbow trout fry. 38 references.

BIOLOGICAL EFFECTS OF RADIATION

231 Action of Temperature During X-Ray Treatment of Tradescantia Chromosomes, by A. C. Faberg. Genetics 33, p. 104, January 1948.

There is agreement among a number of workers that in Tradescantia, the number of chromosome aberrations is smaller if irradiation is conducted at higher temperature. It is plausible to think that it is an effect on rejoining, but attempts to demonstrate this directly by changing the temperature after treatment have not been successful. An experiment is reported in which the time of treatment and the time of temperature change were reduced to a minimum (500 r units in 80 seconds; half period of temperature change 15 seconds), and were short relative to the time that a break remains free, about 4 minutes. The results show that within these time limits, temperature is effective during treatment only, and not if applied before or after treatment. It was also found that change of temperature in either direction immediately preceding treatment increases considerably the number of aberrations. A temperature gradient may subsist in the material as a result of such a temperature change, and this gradient can cause thermal diffusion leading to movement of the chromosome threads. The effect may thus be parallel to that observed when cells are centrifuged during irradiation.

232 The Biological Effects of X-Rays on Mating Types and Conjugation of Paramecium Bursaria, by Ralph Wichterman. Biological Bulletin 94, p. 113-127, April 1948.

Individuals of opposite mating type of Paramecium bursaria were irradiated with roentgen rays at dosages ranging from 100,000 r to 1,000,000 r in steps of 100,000 r. After 100,000 r, locomotion of the paramecia became markedly accelerated but with higher dosages locomotion was retarded. None was able to survive dosages of 700,000 r or more.

Clones of P. bursaria have been established in the laboratory from specimens irradiated with 300,000 r-600,000 r. One result of such irradiation is the destruction of the contained green symbiotic zoochlorellae living with the paramecia. A method is now available for the production of colorless clones of P. bursaria. Colorless P. bursaria as produced by irradiation have the same sex type as before irradiation. Such specimens readily mate and conjugate with members of the opposite sex type. Members of one mating type are more susceptible to x-rays than those of opposite mating type. This may in reality be only a racial, not a sexual difference.

Paramecia of opposite sex types will, when irradiated and mixed, enter into the mating reaction. Clumps thus formed are smaller than in controls and the time taken to form them is greater. The lag in time between conjugation and the mating reaction is dependent upon the dosage. Irradiated conjugants remain joined together in the sexual process much longer than those of the controls. Irradiation inhibits division but the effect is only temporary. After a period of time (depending upon the dosage) survivors have a division rate similar to control specimens. Irradiated culture fluid has no toxic or lethal effect upon unirradiated specimens of P. bursaria. Irradiation-killed specimens of one sex type do not mate or conjugate with living, unirradiated members of the opposite sex type nor does it result in selfing.

BIOLOGICAL EFFECTS OF RADIATION

233 Chromosome Breakage Induced by Absorbed Radioactive Phosphorus, P^{32}, by T. J. Arnason, Elaine Cumming, and J. W. T. Spinks. Canadian Journal of Research 26, p. 109-114, April 1948. (See Guide to Published Research 3, Abstract 438)

Radioactive phosphorus (P^{32}) was made available to individual germinating seeds and seedlings of Triticum vulgare, T. durum, T. monococcum, and Hordeum distichon. Each treated plant was provided with either 0.18 or 0.018 microcuries of P^{32}. Both concentrations were effective in causing chromosome breakage and rearrangements. Many aberrant chromosome configurations occurred in microsporocytes of treated tetraploid and hexaploid plants. Only one chromosome aberration was found in T. monococcum and none in barley. Structural changes occurred also in chromosomes of vulgar wheat grown in soil to which fertilizer containing P^{32} was added. It is possible that the effectiveness of small amounts of P^{32} in inducing mutations is increased by its inclusion in chromosome molecules. Emitted beta particles would then be shot off very close to the sensitive target. Further, the recoiling atomic nucleus is almost certain to have enough energy to break any chemical bond. In any case since there is a change in atomic number (from 15 to 16) and in valence (P valence 5, S valence 2), molecular bonds must be released in the process.

234 Comparison of the Lethal Effect of Neutrons and Gamma Rays on Mouse Tumours (a) By Irradiation of Grafted Tumours In Vivo, (b) By Irradiation of Tumour Fragments In Vitro, L. H. Gray, and John Read. British Journal of Radiology 21, p. 5-10, January 1948.

The mean lethal doses of neutron radiation and γ-radiation on carcinoma 2146 have been measured for irradiation both in vivo and in vitro. The neutron dose, when measured in units corresponding to the production of approximately the same number of ion pairs per cc. of tissue as a rontgen of γ-radiation, is 24 times smaller in the case of the in vivo irradiation, and 9.5 times smaller in the in vitro irradiation. By analogy with the effect of these radiations on the broad bean root it is suggested that the lethal effect is chiefly due to the production of chromosome and chromatid changes.

235 Death after Autogamy in Paramecium Aurelia Following Exposure in Solution to the Radioactive Isotopes P^{32} and $Sr^{89, 90}Y^{90}$, by E. L. Powers, Jr. Genetics 33, p. 120, January 1948.

Sister animals derived from a single exautogamous organism were grown in graded specific activities of P^{32} and of $Sr^{89, 90}Y^{90}$, all β-emitters. After 48 hours exposure, seven to eight cell divisions had occurred, sufficient to incorporate the radioactive substances into the protoplasm to the extent of more than 99 per cent of the theoretical maximum. At this time a series of isolations from each of the solutions was made, and the lines so obtained were allowed to go into autogamy. Survival after autogamy was measured by isolating 108 autogamous animals and noting the proportion that survived six divisions after isolation. The physical parameter was determined by measuring the current output from a vibrating reed-air ionization chamber system for equal volumes of each of the P and of the Sr solutions.

Each activity is expressed in terms of a constant uranium source measured by the same system. In the low dose range, the effect of radioactive P on post-autogamy death is much more marked than that of equivalent levels of radioactive Sr, Y. In terms of ionizations in air, levels of $Sr^{89, 90}Y^{90}$ necessary to produce a degree of death after autogamy exceed by a factor of 4 to 6 the level of P^{32} necessary to produce the same amount of death after autogamy.

BIOLOGICAL EFFECTS OF RADIATION

236 The Differential Effects of Combined Radiations on Chromosome Breakage and Mutation Rate, by C. P. Swanson. Science 107, p. 458, May 7, 1948.

One of the important problems of cytogenetics is the relationship between chromosome change and gene mutations. The solution of the problem is difficult, particularly since the usual mutagenic agents, such as X-rays and short ultraviolet light, also alter chromosome structure. A possible avenue of approach is through the use of additional agents which, while ineffective of themselves, can, when combined with X-rays or ultraviolet, increase or decrease the rate of chromosome change without effecting mutation production, or vice versa.

Infrared, when combined with X-rays, increases the rate of chromosome change (in Tradescantia) and the rate of morphological mutations (in Aspergillus). The chromosome effect is probably due to the infrared affecting the rate of recombination of broken ends of chromosomes but not the initial rate of chromosome breakage. It is likely that the increased rate of mutations is the result of additional chromosome changes having phenotypic effects, since infrared, when combined with ultraviolet (2,537 A) is ineffective in altering the mutation rate. Infrared, therefore, does not affect the stability of the gene. Ultraviolet, when combined with X-rays, does not alter the X-ray-induced chromosome changes.

This selectivity of radiations permits the separation of gene mutations from chromosome changes. The former result from initial absorptions of energy which are not affected by combined treatments, while the chromosome changes which depend upon initial breakage of chromosomes followed by recombination of broken ends, are influenced by addition agents which effect the recombination rather than the initial breakage phase of chromosome alteration.

237 Effects of Graded Dosage of X-Rays on the Production of Eye Facets in the Bar-eyed Race of Drosophila Melanogaster, by W. M. Luce, H. B. Chase, and Henry Quastler. Genetics 33, p. 115, January, 1948.

The eggs and larvae of an inbred strain of the Bar-eyed mutant of Drosophila were treated with X-rays of dosages of 115, 460, 920, 1380 r delivered from 5, 20, 40, 60 seconds respectively. The flies were kept at 28°C. The eggs and larvae were irradiated at different ages ranging from 5 to 86 hours after deposition. The irradiation caused a reduction in facet number provided the time of treatment occurred during an effective period with limits between 48 and 72 hours of egg-larval life. The extent of the reduction increases with the X-ray dosage ranging from 6.75 per cent with 115 r to 41.20 per cent with 1380 r in males, and from 2.83 per cent with 115 r to 34.76 per cent with 138 r in females. Irradiation outside the effective period had no significant effect on facet number except with the lowest dosage, 155 r. In this case treatment before the beginning of the effective period increased the facet number 7.30 per cent in males and 5.92 per cent in females. A comparison of the location of the effective period for X-rays with that for temperature indicates that the former begins earlier. Near the time of the beginning of the X-ray effective period the frontal sacs of the larvae are separating into the optic and antennal lobes. This suggests that the X-rays can act only after these areas are determined. After their separation the optic and antennal lobes begin to grow rapidly. The X-rays produce their effects during this period.

BIOLOGICAL EFFECTS OF RADIATION

238 **Experiments to Test the Validity of the Linear R-Dose/Mutation Frequency Relation in Drosophila at Low Dosage, by Warren P. Spencer and Curt Stern. Genetics 33, p. 43-73, January 1948. (See also MDDC-765)**

200,801 X-chromosomes of mature sperm of a Canton Special stock of Drosophila Melanogaster were tested for the origin of new lethal mutations. Of these chromosomes, 73,901 were controls, 51,907 were subjected to x-rays at a dosage of 25 r, 31,560 at 50 r, 23,195 at 150 r, 6,634 at 500 r, 6,977 at 1000 r, and smaller numbers at 2000 r, 3000 r, and 4000 r. From these tests it is concluded that even for x-ray dosages as low as 50 r and 25 r, the linear r-dose/mutation frequency relation holds. From all of the data collected, on the basis of this linear relationship, the control lethal mutation rate in the Canton Special stock tested was calculated as 0.1004 per cent and the induced mutation rate per r as 0.00215 per cent. When only the data at dosages of 1000 r and lower were included, the control mutation rate was calculated as 0.1039 per cent and the induced mutation rate per r as 0.00197 per cent. The present data indicate that the control mutation rate was doubled at an exposure to about 50 r. The apparent discrepancy between this figure and that of 35 r derived from earlier x-ray experiments may be explained on the ground that sperm cells of young males, which Muller has shown give a high control rate, were used exclusively in this experiment.

Several cases of control "lethal clusters" were found, and are interpreted as due to mutations occurring at early stages in the germ tract. The problem of sampling sperm cells is discussed in this connection. The implications of the findings in connection with the exposure of large numbers of the human race to low dosages of x-rays are discussed briefly. A parallel study of visible mutations rates has given on overall lethal-visible mutation ratio of 5.2 to 1. The data on visibles are not inconsistent with the view that the linear dosage-mutation relation holds at low dosages for this class of mutations as well as for lethals. Linkage studies on 229 lethals and visibles are reported. Relatively high mutation rates both for lethals and visibles were found in genetic chromosome map regions 0-5, 20-25, and 55-60 and a relatively low rate near 10.

Mutations in control chromosomes and in those subjected to low dosages of x-rays were rarely associated with crossover suppressors, while mutations in chromosomes receiving high radiation were frequently associated with crossover suppressors. A bibliography is included.

239 **The Genetic Effects of Non-Sterilizing Doses of Penetrating Radiation, by Frank Ellis. British Journal of Radiology 21, p. 1-4, January 1948.**

Non-sterilizing doses of radiation which cause no demonstrable deleterious effect on the health of the individual may cause serious changes in the chromosomes of the spermatozoa or ova, resulting in manifest disability of various types in subsequent generations. Irradiation changes the hereditary materials, no matter how small the dose. The effects produced are all cumulative with increasing dose, being simply additive for some types of change, but increasing geometrically for others. These changes are almost entirely harmful and therefore undesirable. This information has been gained from the study of organisms other than man. A discussion is given of its application to man and permissible dossage.

BIOLOGICAL EFFECTS OF RADIATION

240 Genetics Effects of Atomic Bombing. Lancet, p. 292-293, February 21, 1948.

The harmful effects of atomic bombing in later generations, resulting from changes induced in the germ cells of survivors, are being studied by a committee on atomic casualties set up by the National Research Council. Two principal types of genetic change are to be expected, gene mutation, and chromosome mutation. The former involves no detectable change in the microscopical appearance of the chromosomes and is presumed to arise from intrinsic changes in a gene. Chromosome mutation involves rearrangement of existing genes, for example by an interchange of segments between two chromosomes, and so may be detected microscopically. The commonest radiation-induced mutations detected in mice are of the chromosome type, and these cause hereditary partial sterility by introducing errors in chromosome distribution during maturation of the germ cells.

241 Human Pathologic Anatomy of Ionizing Radiation Effects of the Atomic Bomb Explosions, by E. DeCoursey. Military Surgeon, p. 427-432, June 1948.

The effect of ionizing radiation on human anatomic structures was studied by means of necropsy findings conducted in Nagasaki and Hiroshima. Investigations were made on those dying during the early period (first two weeks), intermediate period (3-6 weeks) and late period (6 weeks - 4 months). The outstanding symptoms were nausea and vomiting on the day of the bombing, followed by fever, leukopenia, diarrhea, and after two weeks epilation, purpura and oropharyngeal lesions. The spleen showed gross change as early as the fourth day and there was almost total disappearance of blood forming cells in the bone marrow. All parts of the body in which hemorrhage is possible were affected. The gastro intestinal tract was among the first locations to present gross lesions. The tests showed prominent microscopic changes, all dying males having almost all their sex cells destroyed. The ovaries, except for hemorrhages, presented no distinct change and very little microscopically. About the surest macroscopic evidence of ionizing radiation and the most prominent external effect was the epilation of the scalp. (TDD)

242 Inactivation of Bacteriophage by Radiations, and their Bearing on Nature of Bacteriophage, by D. E. Lea and M. H. Salaman. Proceedings of the Royal Society 133 A, p. 434-444, 1946.

The bacteriophages S-13, C-36 and Staph-K were irradiated by γ-rays, X-rays and α-rays. The effect of a given dose was independent of the exposure time, and the survival curve was exponential. For any given phage the inactivation doses of the three radiations increased in the order: γ-rays, X-rays, α-rays, while for any given radiation the inactivation dose of the three phages diminished in the following order: S-13, C-36, Staph-K. A phage particle is probably inactivated by a single ionization. While a single ionization can activate a phage particle, in the case of phages C-36 and Staph-K, it must be produced in a more restricted region to be effective. It is suggested that this radiosensitive region constitutes the genetical material of the phage, and on the basis of this differentiation into genetic and non-genetic material these phages are regarded as primitive single-celled organisms rather than as macromols.

BIOLOGICAL EFFECTS OF RADIATION

243 **Inducing Endosperm Changes in Maize with Neutron Irradiation of Pollen, by E. F. Frolik and Rosalind Morris. Genetics 33, p. 105, January 1948.**

Maize tassels of A Pr Su plants were placed in the thermal neutron column of a heavy water pile for 0, 1, 2, 4, 8, and 16 minutes, respectively. The flux was 7×10^{19} neutrons per square centimeter per second. Pollinations were made on untreated a pr su plants. Effects were determined on the resulting kernels. With respect to the A, Pr, and Su loci, neutron irradiation resulted in an increased number of mutations affecting the entire tissue involved, but had no significant effect on number of chimeras or on percentage of mutated kernels with recoveries. The percentage of defective kernels increased consistently with duration of treatment.

244 **The Influence of Cosmic Radiation Showers Arising from Lead Plates on the Rate of Carcinogenesis, by F. H. J. Figge. Anatomical Record 97, p. 386-387, 1947.**

245 **Influence of Roentgen Rays on Isolated Cell Nuclei, by Hans von Euler and L. Hahn. Acta Radiologica 27, p. 268-280, 1946.**

Nuclei carefully isolated from calf thymus at pH 4-6 were irradiated with 25,000 and 65,000 r to compare the physiological state of isolated cell nuclei with their state in a living tissue. Nucleoproteins were prepared from the irradiated nuclei and characterized by analysis, and by viscosity, dialysis and adsorption measurements. A study of the properties of the nucleoproteins showed no significant changes due to the irradiation. This result is not interpreted as meaning that the nuclei have totally lost their biological activity.

246 **Partial Destruction of Rat Thyroid by Large Doses of Radio-Iodine, by D. Findlay and C. P. Leblond. American Journal of Roentgenology and Radium Therapy 59, p. 387-395, March 1948.**

Two adult female albino rats, kept on a low iodine diet for ten weeks, were given single doses of 78.5 and 60.8 microcuries of carrier-free radioiodine, I^{131}, respectively. Thyroid function was estimated by basal metabolic rate and heart rate determination. After six days the animals were sacrificed and the thyroid histology studied by means of stained sections and autographs. It was calculated that about 20,000 equivalent roentgens were received by the thyroid glands of the animals. Such doses of radioiodine impair the function of the thyroid, as suggested by some decrease in oxygen consumption and heart rate of the animals. The histological study of the thyroid glands of these animals shows destructive lesions of the follicles especially in the central areas of the gland. Many peripheral follicles retain a normal appearance. Autographic studies show that only the normal looking follicles with smooth colloid have the ability to retain radioiodine. Although the thyroid gland is resistant to the action of radiations, it can be destroyed by the isotope I^{131}. The damage is favored by the retention of radioiodine inside the thyroid follicles until they are markedly damaged.

BIOLOGICAL EFFECTS OF RADIATION

247 **The Relative Effectiveness of Fast Neutrons and Gamma Rays in Producing Somatic Crossing Over in Drosophila, by George Lefevre, Jr. Genetics 33, p. 113, January 1948. (See also MDDC-1423-B)**

Heterozygous white and eosin-white female larvae were exposed 24 to 30 hours after egg laying to gamma rays and fast neutrons. The incidence of resulting eye color mosaics was much higher than in males, and was dependent upon the rate at which the total dose was administered. Heterozygous females with a double inversion in one X-chromosome showed no increase in mosaic incidence. Neutrons were relatively much more effective, per ionization, than gamma rays. Evidence was found that mosaic size and age at exposure are not simply related. Twin mosaics in eosin-white females showed great inequality in size. Possible mechanisms for radiation induced somatic crossing over that require two hits within a limited length of time are considered.

248 **The Relative Effectiveness of Fast Neutrons and Gamma Rays in Producing Somatic Mutation in Drosophila, by George Lefevre, Jr. Genetics 33, p. 112, January 1948. (See also MDDC-1423-A)**

Following exposure to gamma rays and fast neutrons 26 hours after egg laying, the incidence of white and light eye color mosaics was 4 times as high in eosin males as in wild-type males, and twice as high as in eosin with mutations at various other loci, rather than from a high mutability of the eosin gene. Using the data from wild-type males, a mutation constant for somatic mutation at the white locus was calculated, showing the same order of magnitude as that for germinal mutation. Mosaic incidence following neutron exposures was higher than expected compared to gamma ray exposures, indicating that neutrons are not less effective per ionization, in producing mosaics.

Nuclear Science Abstracts supersedes two previous AEC abstract journals, Abstracts of Declassified Documents and Guide to Published Research on Atomic Energy. No copies of the latter journal are available. Back issues of the Abstracts of Declassified Documents may be purchased from the Document Sales Agency.

BIOLOGY, GENERAL

249 The Accumulation of Radioactive Iodide by the Thyroid Gland in Normal and Thyrotoxic Subjects and the Effect of Thiocyanate on Its Discharge, by M. Stanley and E. Astwood, Endocrinology 42, p. 107–123, 1948.

After the administration of anti-thyroid medication, thyroid hormone synthesis was also almost completely inhibited, but the human thyroid gland was still able to collect appreciable quantities of radioactive iodine. After administration of thiocyanate or large quantities of ordinary iodine the collected iodine was promptly, although not completely discharged from the thyroid gland. The uptake of radioactive iodine in thyrotoxic patients was much greater than normal, and the rate of discharge was more rapid after administration of thiocyanate or normal iodide.

250 Influence of Female Sex Hormone on Uptake of Radioactive Iodine by the Thyroid, by K. E. Paschkis. Federation Proceedings 6, p. 176-177, 1947.

251 The Polarigraphic Method in Biology and Medicine, by I. E. Elphner. Uspekhi Sovremennoĭ Biologii 23, No. 2, February 1947. 20p. (In Russian).

A general discription of the polarigraphic method, polarigraphic analysis of inorganic substances in biologic tissues, polarigraphic maximums, polarigraphic analysis of biologically active organic substances, polarigraphic catalytic protein waves, catalytic protein waves, and symptoms of cancer are discussed.

252 Radioactivity Distribution in the Tissues of Mice Bearing Melanosarcoma After Administration of DL-Tyrosine Labeled with Radioactive Carbon, by James C. Reid and Hardin B. Jones. Journal of Biological Chemistry 174, p. 427-437, June 1948. (See also MDDC-1404).

The synthesis of DL-tyrosine labeled with C^{14} in the β-position is described. The distribution of radioactivity following intravenous administration of DL-radiotyrosine to mice bearing melanosarcoma has been investigated. At 72 hours, about 30 per cent of the administered dose has appeared in the breath, about 40 per cent in the urine and feces, with 30 per cent remaining in the body. Radioactivity is found in every tissue of the body. The adrenals, thyroids, intestines, kidneys, liver, plasma, spleen, and tumor show the highest specific activities. Erythrocytes are lowest, with bone next. In this species, the total activity in the body diminishes by half during the 60 hour period between the 12th and 72nd hour after administration of radiotyrosine.

253 The UFAW Handbook on the Care and Management of Laboratory Animals; With an Appendix on Statistical Analysis, ed. by Alastair N. Worden. London, Baillière, Tindal, and Cox, 1947. 368 p.

BOTANY, GENERAL

254 Effect of Radioactive Materials on Stimulating Plant Growth, by Carl B. French. Canadian Chemistry and Process Industries 32, p. 225-226, March 1948.

As a result of experiments on five vegetables the author concludes that the use of radioactive materials in conjunction with commercial fertilizers tends to increase the mean yield of many crops.

255 Procedure for Measurement of P^{31} and P^{32} in Plant Material, by A. J. MacKenzie and L. A. Dean. Analytical Chemistry 20, p. 559-560, June 1948.

A routine quantitative procedure for determining the specific activity of plant material containing radioactive phosphorus has been successfully applied to vegetative samples from greenhouse and field experiments. By comparison of the specific activity of the fertilizer preparation with that of the plants grown on soil receiving this fertilizer, the proportion of the phosphorus contained in the plants derived from the fertilizer may be estimated.

CHEMISTRY, ANALYTICAL

256 The Interpretation of Spectra, by William Mayo Venable. New York, Reinhold, 1948. 200 p.

257 A Method of Semi-Quantitative Spectrographic Analysis, by C. E. Harvey. Glendale, Calif., Applied Research Laboratories, 1947. 285 p.

CHEMISTRY, GENERAL

258 The Distribution of Thorium Nitrate Between Water and Certain Alcohols and Ketones, by B. F. Rothschild, C. C. Templeton, and Norris F. Hall. Journal of Physical and Colloid Chemistry 52, p. 1006-1020, June 1948.

The distribution of thorium nitrate has been determined at room temperature between water and each of the following solvents: isoamyl alcohol, n-hexyl alcohol, methyl isobutyl ketone, methyl n-amyl ketone, and methyl n-hexyl ketone. These five organic solvents appear to be the most promising for the liquid-liquid extraction of thorium nitrate from aqueous solutions also containing the nitrates of the rare earths and zirconium. The effect of added nitric acid has been ascertained on the systems containing n-hexyl alcohol and methyl n-hexyl ketone. Some preliminary extractions with methyl n-hexyl ketone are described to show the applicability of the conclusions drawn from these distribution data.

CHEMISTRY, GENERAL

259 Synthesis of Symmetrically Labeled Acetic Acid from Barium Carbonate, by R. Abrams. Experientia 3, p. 488-489, 1947. (In English)

A method of preparation of acetic acid in which C^{13} or C^{14} is distributed uniformly between the methyl and carboxyl groups is described. Barium carbonate containing the desired carbon isotope is reduced to barium carbide by a stream of hydrogen gas between 700-750°C using magnesium powder as a catalyst. The carbide is decomposed with water forming acetylene, which in two is converted to potassium acetate by heating in the presence of potassium hydroxide-coated asbestos at 250°C. Sulfuric acid is added, and the labeled acetic acid formed is distilled off. The yield is 60-80%.

COSMIC RADIATION

260 Cosmic-Ray Investigations on Mt. McKinley, by Thomas D. Carr, Marcel Schein, and Ian Barbour. Physical Review 73, p. 1419-1423, June 15, 1948.

Three cosmic-ray experiments were carried out on Mt. McKinley (Alaska) at an altitude of 18,100 feet. The first experiment measures the absorption curve of penetrating particles in Pb thicknesses up to 50 cm. A large number of slow mesotrons of energies around 200 Mev was found. From the measured mesotron energy spectrum on Mt. McKinley a calculation was made to determine the spectrum which would be anticipated at 14,250 feet (Mt. Evans, Colorado). The result is compared with experimental data obtained on Mt. Evans. The discrepancy between the two curves strongly indicates that an additional production of mesotrons of energies less than 400 Mev takes place in the atmosphere between these altitudes. Two other experiments at 18,000 feet investigate the production of penetrating particles by ionizing and non-ionizing radiation in lead and paraffin.

261 Determining the Trajectory of Cosmic Rays and Time Fields in Media with Varying Speed, by I. S. Berzon. Izvestiya Akademii Nauk SSSR, Seriya Geograficheskaya i Feofizicheskaya 11, p. 47, January–February 1948.

262 Meson Scattering with Nuclear Excitation, by H. J. Bhabha and R. R. Daniel. Nature 161, p. 883-884, June 5, 1948.

In examining a number of Ilford C2 plates, loaded with boron, and exposed to cosmic rays in aeroplanes at an average altitude of 8,000 ft. for about 72 hours, the author came across an interesting track which is reproduced in the article and discussed. It is concluded that the track is due to the scattering of a meson by a nucleus in which the nucleus is not disrupted but simply excited. This is the first time that experimental evidence for the phenomena has been obtained.

DEUTERIUM

263 The D + D Cross Section at Low Energies, by A. P. French. Physical Review 73, p. 1474, June 15, 1948

In a paper recently published by Bretscher, French, and Seidl (Physical Review 73, p. 815, 1948) measurements are described of the thick target yield of the D(d,p) reaction between 15 and 105 Kev. If the work of Crenshaw in this field (Physical Review 62, p. 54, 1942) is taken into account the D + D cross section at any energy becomes approximately 10 per cent lower than is stated in this paper.

264 Determination of Deuterium in Water; A Mass Spectrometric Method, by Robert B. Fischer, Richard A. Potter, and Roger J. Voskuyl. Analytical Chemistry 20, p. 571-572, June 1948. (See also MDDC-1208)

A procedure is given for the determination of deuterium in water of any isotopic composition. The procedure is simple and rapid when the equipment is available. The method does not, in general, require any removal of dissolved impurities as would be the case for a specific gravity method. The water sample may be recovered practically unchanged after the analysis is completed.

HEALTH PROTECTION

265 Army Doctors Say Mass Hysteria Need Not Follow Atomic Bomb Explosion. Military Surgeon 102-6, p. 501-503, June 1948.

Army doctors, who are conducting continuous study of the problem of atomic bomb explosions, state that although the population would be faced with the greatest emergency of its history, the entire population would not be wiped out, and measures to help the survivors could be made. Many lives may be saved by a widespread knowledge of therapeutic measures among physicians and a general understanding of preventive measures. Four known kinds of radiation can be expected within the immediate area of the blast. The gamma radiation is similar to the X ray and is lethal to a distance of a mile of the blast. Neutron beams passing through matter such as blood, bone, or flesh produce ionization of the atoms which make up body cells. Beta rays and alpha particles cause superficial damage. (TDD)

266 Health Experiences in the Fields of Manufacture and Use of Beryllium Alloys and Beryllium Compounds. Reading, Pa., Beryllium Corporation, 1948. 4p.

This pamphlet indicates that little or no health hazards are involved in the manufacture of beryllium alloys and compounds. 13 references.

267 Observations on the Development of Graphite Pneumoconiosis, by Lasar Dunner. British Journal of Radiology 21, p. 182-185, April 1948.

One form in which graphite pneumoconiosis can occur is the miliary ("snowstorm") type. From this type lesions of advanced pneumoconiosis may develop in such a way that the original "snowstorm" pattern can not be recognised. Three cases histories and ten X-ray photographs are used to illustrate the cases.

HEALTH PROTECTION

268 Saranac Symposium on the Beryllium Problem. Journal of the American Medical Association 137, p. 648, June 12, 1948.

A symposium held at the Saranac Laboratory for the Study of Chest Diseases at Saranac Lake, N.Y., during the week of Sept. 29, 1947 attempted to bring together available data on the health hazards resulting from exposure to beryllium compounds.

INSTRUMENTS

269 Quartz Spring Joly Balance, by I. Sheft and S. Fried. AECD-2082 (ANL-4130), March 22, 1948, decl. June 24, 1948. 4p. Document for sale by AEC. (For publication in Review of Scientific Instruments. This includes declassification of the quartz spring Joly Balance.)

In the course of work involving the use of a quartz spring Joly Balance, it was observed that the elongation of the spring when under a constant load varied slightly over several hours. This effect can be eliminated by surrounding the portion of the tube containing the spring with a thermostated water jacket. The effect is believed to result from the change in rigidity modulus of quartz with temperature.

270 A Combined Creep Machine and X-ray Spectrometer, by H. J. Tapsell, H. V. Pollard, and W. A. Wood. Journal of Scientific Instruments 25, p. 198, June 1948.

The instrument described is used in the study of the mechanical properties of metals in relation to X-ray structure, particularly their creep behaviour at elevated temperatures. Special features incorporated in the design permit the X-ray examination of a specimen at various times while it is creeping under a stress which is kept constant throughout the period of uniform stretching, and the specimen is oscillating about its axis and the X-ray film oscillating in its own plane. A photograph and a diagram of the machine are shown.

271 Compact Electrostatic Generator for the Production of Positive Ions, by W. E. Danforth, E. L. Hudspeth, C. E. Mandeville, and C. P. Swann. Physical Review 73, p. 1413-1418, June 15, 1948.

The design and operational characteristics of a compact pressurized electrostatic generator are described. The machine is operated in a pressure vessel with an over-all height of 13 feet, and positive ions have been accelerated to energies up to 1.75 Mev through a tube 5 feet long. The potential gradient thus achieved along the tube is 350 kv/ft., which is considerably greater than the average value achieved by other positive ion accelerators thus far reported. It is believed that even the present voltage limitation can be extended.

INSTRUMENTS

272 The Effect of the Composition of the Gas Mixture in Self-Quenching Geiger-Muller Tubes on Their Plateau Characteristics, by S. J. Du Toit. Physical Review 73, p. 1473-1474, June 15, 1948.

The effect of the composition of the gas mixture in self-quenching Geiger-Müller counters on their properties has been described by a number of authors. Rochester and McCusker, using alcohol at 40°C, found the interesting result that at a pressure of 6 cm of Hg of the quenching gas, the plateau of a given tube vanishes completely. They advanced the hypothesis (Nature 156, p. 366, 1945) that the effect may be caused by the fact that the threshold voltage increases linearly with the alcohol pressure, and that ions in the positive sheath may thus reach the cathode with sufficient energy to cause a liberal emission of electrons.

The author describes his experiment to test this hypothesis. He concludes that under certain conditions the disappearance of the plateau is probably caused by photon absorption becoming so high that the discharge has difficulty in spreading along the length of the wire as postulated by Weisz (Physical Review 62, p. 477, 1942). Under other conditions it seems as if secondary emission from the cathode at threshold voltage is responsible for the plateau becoming zero, thus confirming the Rochester and McCusker explanation.

273 Optimum Conditions for a Beta-Ray Solenoid Spectrometer, by E. Persico. Physical Review 73, p. 1475-1476, June 15, 1948.

With a beta-ray spectrometer a compromise must be made between the resolving power and the luminosity. A theoretical investigation is presented of the optimum conditions obtainable with a magnetic lens spectrometer of the solenoid type, with uniform field and a baffle system utilizing ring focus which eliminates the main part of the spherical aberration.

274 Remarks on Diamond Crystal Counters, by Kathleen Lonsdale. Physical Review 73, p. 1467-, June 15, 1948.

The characteristics of the Type I and II diamonds, and their suitability as γ-radiation counters are briefly discussed.

ISOTOPES

275 Direct Methods of Isotopic Identification in Nuclear Research, by A. P. Grinberg. Uspekhi Fizicheskikh Nauk 34, p. 303, February 1948. (In Russian)

ISOTOPES

276 Radioactive Contaminants in Tracers, by Waldo E. Cohn. Analytical Chemistry 20, p. 498-503, June 1948. (See also MDDC-1643)

The physical and chemical principles underlying the origin, detection, and removal of radioactive impurities in tracer materials are discussed from the standpoint of the individual user. Specific examples, drawn from every-day experience, are given as illustrations of all general causes, techniques, and procedures involved, to the end that tracer experiments may not suffer from the introduction of impurities, and that the removal of impurities may be most conveniently and efficiently accomplished. 39 references.

277 Fission Products, by W. E. Grummitt. Proceedings of the Conference of Nuclear Chemistry, Chemical Institute of Canada, 1947, Part 1, p. 93-100.

A number of light and heavy group fission product chains are described. The isolation, identification and quantitative analysis of some fission product elements are considered.

278 Radioisotopes Conference. Chemical and Engineering News 26, p. 1715, June 7, 1948.

Eleven papers by scientists from Argonne National Laboratory and participating universities were presented during a conference on the measuring, processing, and handling of radioisotopes sponsored by the biology division of the laboratory and held at the Museum of Science and Industry in Chicago on May 21-22, 1948. A round-table discussion on the use of isotopes concluded the meeting.

LABORATORIES

279 Techniques Generales du Laboratoire de Physique, ed. by J. Surugue. Paris, Centre de Documentation du Centre National de la Recherche Scientifique, 1948. 433 p. (In French).

Among the topics discussed are: general principles of construction of scientific apparatus; methods of laboratory glass blowing; vacuum techniques; high temperature controls and apparatus; optical systems and techniques; illumination and filters; photoelectric cells; recording processes; and regulation and rectification of voltage and currents.

METALLURGY

280 Metallic Titanium Is Light, Strong, Durable, and Corrosion Resistant, by E. A. Gee, J. R. Long, and W. H. Waggaman. Materials and Methods 27, p. 75-78, January 1948.

The supply situation and manufacturing methods are reviewed. The properties of metallic titanium and its present and potential uses are also discussed.

METALLURGY

281 A Method for Obtaining Metals, Part II; by Raymond Lautie and Andre Moutet. Bulletin de la Société Chimique de France, p. 881-883, September-October, 1947. (In French).

Calcium carbide was used to reduce Be and Mg minerals under vacuum. Metal recovery was made by distillation in yields exceeding 80 per cent. The metals were obtained in a very pure state.

282 The Structure of Metals and Alloys, by William Hume-Rothery. London, Institute of Metals, 1948. 137 p.

MINERALOGY

283 Determination of Zirconium in Ores, by Henry Brutcher. Handbuch für das Eisenhüttenlaboratorium 1, p. 118-120, 1939.

A qualitative and quantitative gravimetric method is described which is also applicable to hafnium.

284 The Estimation of Uranium and Thorium from the Beta Radioactivity of Minerals, by B. D. Nag and A. K. Mousuf. Proceedings of the National Institute of Sciences of India 12, p. 341-349, August-October 1946.

The authors describe a method of estimating the quantity of uranium and thorium in minerals and rocks by measuring the beta-ray activity of the samples. The ionization currents due to the emitted beta particles are detected by the deflection of the light spot on the scale of a sensitive galvanometer. The method is said to be very quick and reliable for radioactive measurements provided the total radioactive content is above 1% of the mineral or rock. The thorium and uranium contents of the minerals investigated (thorianite, samarskite, and pitch blende) are given. A drawing of the ionization chamber constructed by the authors and a bibliography are included.

285 Investigation of the Radioactivity of Rocks by the Photographic Method, by J. H. J. Poole and J. W. Bremner. Nature 161, p. 884-885, June 5, 1948.

The method employed is to place an Ilford Nuclear Research plate at a distance of about 0.1 mm. from a flat surface of the specimen cut with a diamond saw, and expose it for one to three weeks, depending on the probable activity of the specimen. In more recent experiments the plate has been placed in contact with the cut surface, as this makes easier the identification of α-rays tracks, which all originate from one nucleus. Theoretically, from the frequencies of two-, three-, four- and five-ray stars, it should be possible to estimate the separate amounts of uranium and thorium present. Enough data have not yet been obtained to determine whether this method will prove possible. The results of some experiments are reviewed briefly.

MINERALOGY

286 **Optical Properties of Glass from Alamogordo, New Mexico, by Clarence S. Ross. American Mineralogist 33, p. 360-362, May-June 1948.**

The explosion of the atomic bonb at Alamogordo, New Mexico, fused the immediate surface of the arkosic sands of the area. This produced two distinct types of glass, one derived from the feldspar clay fraction of the sands, and the other from direct fusion of the quartz to silica glass. The properties and relations of these materials are described in detail.

Periodicals listed in this abstract journal are on file in the Library of Congress. The Union List of Serials may be consulted for the availability of these publications in other libraries. Members of the American Chemical Society may purchase microfilms or photoprints of some of the articles listed through this Society.

NEUTRONS

287 Introduction to the Theory of Nuclear Reactors, by R. E. Marshak, H. Brooks, and H. Hurwitz, Jr. AECD-2072, 1946, decl. June 22, 1948. 88 p. (For publication in Nucleonics)

A presentation is made of the Boltzmann equation for the diffusion of neutrons with no change in energy. It is shown how the diffusion equation can be obtained from the Boltzmann equation with the appropriate assumptions. The relation between the neutron density due to a point source, and the neutron density due to a plane source is derived. The solution of the diffusion equation is given for a plane source located in a semi-infinite medium. The rigorous solution of the Boltzmann equation for a plane source is derived, and the relation between the rigorous solution and the diffusion theory solution is discussed. The corrections which must be applied to diffusion theory near boundaries are discussed. The concept of extrapolated endpoint is introduced, and the angular distribution of neutrons emerging from a plane surface is described. A more careful treatment is given of the problem of a plane source close to a plane boundary. A spherical harmonic method is described, and its use in calculating the critical thickness of a plane slab is discussed. Integral equation methods for computing critical masses are also discussed. In particular, the extrapolated endpoint technique and the variational technique are described.

Slowing down of neutrons by elastic collisions with nuclei is discussed. A deviation is given of the collision function which gives the distribution of energy losses in a collision. The Boltzmann equation appropriate to the case where slowing-down by elastic collision occurs is given, and it is shown how the Fermi age theory may be derived from this equation with appropriate assumptions. The solution of the age equation is given for a point source. The ranges of validity of the assumptions necessary for obtaining the age equation are carefully discussed. The solution is given for the problem of a point source in a semi-infinite medium bounded by another semi-infinite medium with the same atomic scattering cross-section as a function of energy but different density. The solution of the age equation near a boundary is discussed. The various schemes of improving age theory are described, and the nature of the deviations of the more exact solution from the age theory solution is indicated. The problem of slowing-down with capture is discussed, and the appropriate modification of the age equation is made. The space independent slowing-down problem is carefully discussed.

The deviations of the rigorous solution, from the elementary solution at energies just below the source energy, are described. The effect of absorption on the slowing-down density is discussed, and the absorption due to narrow resonances is considered.

288 Thin Target (α,n) Cross Sections of Be, Mg, and Al, by I. Halpern. AECD-2080 (LADC-500), n.d., decl. June 17, 1948. 1 p. (For publication by the American Physical Society)

This report is an abstract and is presented here in full.

The (α,n) cross sections for Be, Mg, and Al were measured as a function of alpha energy up to the full energy of Po alphas. The cross sections were determined by counting the neutrons released in the reactions in a graphite block with a slow-neutron counter. The energy response of the counting apparatus was reasonably "flat". The disintegration chamber was of spherical geometry and target and source thicknesses were such that the energy resolution was of the order of 5%.

The lowest resonance in Be occurs at 1.75 Mev and its shape is well enough defined to permit assignments of probable widths for neutron and α emission and a less certain assignment for the angular momentum of the level. The cross section at this resonance is .15 barns and rises to .4 barns at 5 Mev. The aluminum and magnesium cross sections are smaller by a factor of about 20 and no resonances can be identified with certainty.

NEUTRONS

289 Interaction of Neutrons and Nuclei, by V. N. Kondrat'yev. Uspekhi Fizicheskikh Nauk 34, p. 169, February 1948. (In Russian)

290 (n,2n) Process with Beryllium with Neutrons from a (Po-α + Be) Source, by F. G. Houtermans. Nachrichten von der Gesellschaft der Wissenschaften zu Göttingen, p. 52-54, 1946.

The effective cross-section for the (n,2n) process in Be was calculated to be $(3.6 \pm 1.0) \times 10^{-24}$ sq. cm.

291 Retardation of Neutrons by Heavy Atoms, by Karl Krebs. Zeitschrift für Naturforschung 23, p. 435-438, 1947.

The retardation efficiencies of the following liquids for neutrons from a beryllium-radium emanation source were determined: water, methyl alcohol, ethyl alcohol, propyl alcohol, amyl alcohol, formic and acetic acids, benzene, toluene, xylene, pentane, glycerol, methyl acetate, ethyl acetate, amyl acetate, acetone, ethyl ether, and an aqueous solution of ammonium nitrate. The data determined are presented graphically.

NUCLEAR PHYSICS – METHODS OF MEASURING

292 Beta-ray Counters, by R. S. Krishman. Current Science 17, p. 37-43, 1948.

A description is given of the construction and characteristics of some beta-ray counters suitable for measuring the activity of low-energy beta particles. Also included are circuits for a suitable amplifier and stabilized high-voltage unit for use with these counters.

293 A New Method of Determining Short Half-Value Periods, by S. Rowlands. Journal of Scientific Instruments 25, p. 218-220, June 1948.

A simple method of measuring radioactive half-life periods in the range 10^{-6} to 10^{-1} seconds is described. This is achieved by determining the time intervals between radiations emitted at the beginning and the end of the life of a radioactive nucleus with a high-speed single-sweep oscilloscope. An application of the method to the measurement of the half-life period of radium C′ (Po^{214}) is described. It is also possible to use this method to determine the intensity of weak radioactive sources and the efficiencies of Geiger-Muller counters.

NUCLEAR PHYSICS–METHODS OF MEASURING

294 Radiation Counter Tubes and Their Operation, by Nicholas Anton. Electronic Industries and Electronic Instrumentation 2, p. 4-7, February 1948.

An elementary description of the principles and of the various types of radiation counter tubes is given.

NUCLEAR PROPERTIES

295 Resonance Phenomena in Proton Capture Processes, by R. Tangen. Kongelige Norske Videnskabers Selskabs, Forhandlinger 15, No. 46, p. 177-180, 1942. (Pub. 1943) (In English).

Resonance energies in Kev and intensities in counts per microcoulomb were determined for the elements listed below. Since target thickness varied from one element to another, intensities are not comparable. Li^{7}: 440, 375.0; Be^{9}: 330, 0.4; B^{11}: 162, 7.5; C^{12}: 460, 0.3; C^{13}: 550, 0.3; N^{14}: 277, 0.23; N^{15}: 428, 0.94; F^{19}: 340, 17; 485, 415; Na^{23}: 250, 0.01; 310, 2.3; 385, 0.06; 510, 1.7; Mg^{25}: 222, 0.14; 315, 0.01; 395, 0.02; 422, 0.42; 500, 0.06; 518, 0.05; 535, 0.02; Mg^{26}: 294, 0.05; 320, 0.16; 340, 195; 390, 0.22; 435, 0.44; 457, 4.05; 502, 0.2; Al^{27}: 295, 0.03; 325, 0.12; 402, 0.3; 445, 0.1; 500, 1.8; Si^{29}: 320, 0.02; 413, 0.11; Si^{30}: 363, 0.03; 497, 0.08; P^{31}: 355, 0.08; 440, 0.4; 540, 1.6; Cl^{37}: 430, 0.03; 447, 0.18; 500, 0.09; 530, 0.4.

NUCLEAR THEORY

296 Mesons and Nucleons, by O. Klein. Nature 161, p. 897-899, June 5, 1948.

The author presents an approach to the problem of the relation between mesons and nucleons, which, although speculative, seems to give a reasonable account of the main features of our present knowledge.

297 The Theory of Pseudoscalar Meson in Presence of Electromagnetic and Nuclear Fields, by R. C. Majumdar. Proceedings of the National Institute of Sciences of India 11, p. 109-121, 1945.

The properties of a pseudoscalar meson field are described, and the general theory of pseudoscalar mesons in the presence of electromagnetic and nuclear fields is considered. Using charged, symmetrical, and neutral theories, the scattering of pseudoscalar mesons by nuclear particles is calculated. The creation of meson pairs by photons and charged particles, the production of pseudoscalar mesons by photons, and the capture of mesons with emission of photons are discussed.

NUCLEAR THEORY

298 The Theory of Radiation Loss by Mesons, by R. C. Majumdar. Proceedings of the National Institute of Sciences of India 11, p. 103-108, 1945.

Using the virtual quanta method the emission from a fast meson moving in the field of a nucleus was investigated. The radiation emitted by a meson of spin one is due chiefly to the Compton scattering of the initial quanta, whose frequencies are as a result of radiation reaction approximately $(28815)^{\frac{1}{2}} \times 137\,\mu c^2/h$ where μ is the meson mass. For mesons of zero spin the effect of radiation is negligible and the frequency is of the order $\mu c^2/h$.

NUCLEAR TRANSFORMATION

299 Characterization of Tc Activities Produced by Deuteron Bombardment of Separated Mo Isotopes, by E. E. Motta and G. E. Boyd. AECD-2073, May 18, 1948, decl. June 21, 1948. 14 p. Document for sale by AEC. (For publication in Physical Review; See also AECD-1944, 2074)

Deuteron bombardments on Mo^{94} led to the formation of a Tc activity which decayed with a half-life of 50 ± 2 minutes, and which emitted positrons of 2.5 ± 0.3 Mev energy. The assignment of the 50 minute Tc period to mass 94 is considered probable. One hour deuteron bombardments on Mo^{95} were observed to give rise to a Tc activity of 20 ± 2 hour half-life which decayed with the emission of 16.5 ± 1.5 Kev X-rays, and a gamma ray of 0.8 ± 0.1 Mev energy. Yield considerations have led to the assignment of this period to mass 95.

Deuteron irradiations on Mo^{98} varying between forty minutes and one hour were found to yield another Tc activity of 2.8 ± 0.1 day half-life. Beta rays of 1.3 ± 0.2 Mev maximum energy, and gamma rays of 0.9 ± 0.1 Mev were found to be associated with this period. The yield in the production of 2.8 day Tc activity makes its assignment to mass 98 probable.

300 Long Lived Tc Activities Produced by Deuteron Bombardment of Separated Mo Isotopes, by E. E. Motta and G. E. Boyd. AECD-2074, June 4, 1948, decl. June 21, 1948. 6 p. Document for sale by AEC. (For publication in Physical Review; See also AECD-1944, 2073)

4.2 day Tc was produced in greatest yield from 22 Mev deuteron bombardment of Mo enriched in Mo^{96}; it decayed with a half-life of 4.2 ± 0.1 days. This result serves to confirm the assignment of the 4.2 day Tc to Tc^{96}. Gamma rays of 0.8 ± 0.1 Mev energy as well as 17-18 Kev X-rays were observed. The 50-60 day Tc was produced in greatest yield from the deuteron bombardment of Mo enriched in Mo^{95}. The decay curve gave an apparent half-life of 59 days. The radiations found associated with this period were a 0.8 ± 0.1 Mev γ-ray, a 0.24 ± 0.05 Mev γ-ray, and X-rays characteristic of the Mo-Tc region. Earlier work on the approximately 90 day Tc had indicated its assignment to mass 97. It was to be expected that a d,2n reaction would give the greatest yield of Tc^{97} when carried out on Mo enriched in Mo^{97}. This hypothesis was found to be true, and confirms the assignment of the 90 day Tc to mass 97.

NUCLEAR TRANSFORMATION

301 The Formation of U^{232} by Helium Ions on Thorium, by A. S. Newton. AECD-2081 (UCRL-84), April 14, 1948, decl. June 25, 1948. 6 p. Document for sale by AEC (For publication in Physical Review)

The production of U^{232} by the sum of α,4n and α,p,3n reactions on thorium has been studied. The cross section at an average energy of 37.5 Mev was 0.013 barns and the threshold for the reaction was about 30 Mev.

302 Carbon of Cosmic Origin. Atomes 3, p. 137, April 1948. (In French).

There is evidence that carbon of mass 14 is formed in the atmosphere as a result of bombardment of nitrogen by neutrons originating from cosmic radiation.

303 Complete Disintegration of the Silver Nucleus by Cosmic Rays, by L. Leprince-Ringuet. Atomes 3, p. 96-97, March 1947. (In French).

Recently developed photographic emulsions have made possible new studies on the effect of cosmic radiation. A 34 branched star has been observed from the disintegration of a silver nucleus by cosmic rays. These branches have been attributed to protons, tritons, and α-particles resulting from the disintegration of a silver nucleus.

304 Meteoric Helium, by Carl August Bauer. Astronomical Journal 53, p. 110, 1948.

The nuclear disruption of uranium and thorium by cosmic rays may be the explanation of the relatively large amounts of helium found in small meteors. The helium thus resulting as a disintegration product is added to the helium originally present in the meteor.

305 Production of New Tc Activities from Separated Mo Isotopes, by E. E. Motta and G. E. Boyd. Physical Review 73, p. 1470-1472, June 15, 1948. (See also AECD-1944, 2073, 2074)

This note reports a part of the results from a general program for the characterization and assignment of the various radioactivities of element 43 produced by deuteron bombardment of several Mo isotopes. Half-lives, energy values for the various radiations emitted, and in some cases mass number assignments are given for the following Tc activities: 80-second, 4.5-minute, 40-minute, 2.8-hour.

PARTICLE ACCELERATORS

306 Design of the Radio-Frequency System for the 184-Inch Cyclotron, by K. R. MacKenzie, F. H. Schmidt, J. R. Woodyard, and L. F. Wouters. AECD-2071 (UCRL-64), n.d., decl. June 23, 1948. 38 p. Document for sale by AEC. (For publication in the Journal of Applied Physics)

A description is given of the frequency-modulated oscillator and its associated rf circuits as used in the 184-inch cyclotron for accelerating deuterons to 190 million volts or alpha particles to 380 million volts. A 9C21 water cooled tube is used in a grounded-grid circuit which is tightly coupled to the single-dee resonant circuit so that the oscillator follows the frequency of the dee over the wide range required. During normal operation the oscillator delivers approximately 20 kw of rf power to the dee system at an efficiency of 60 per cent, giving 20 kv at the front of the dee, although the oscillator is capable of considerably more output. The frequency is swept from 12.5 mc to 9.0 mc approximately 100 times per second by a rotating condenser connected to the dee by a half-wave transmission line. Much of the history of the design, and reasons for choices made, are given, as it is felt this may be useful to others designing frequency-modulated oscillators for cyclotrons.

307 The Choice of Operating Mode for Standing Wave Type Linear Accelerators for Electrons, by Elliott J. Lawton. Journal of Applied Physics 19, p. 534-539, June 1948.

Experimental studies of the wave-length spacing between modes of the spectrum of arrays of 10 and 16 cavities with different cavity-to-cavity couplings have been made. The results indicate greatest mode separation near the center, $\pi/2$ mode of the mode spectrum making this mode best for operation. Use of the end π-mode of the spectrum should lead to a limiting length of approximately 3 to 6 feet, while choice of the center $\pi/2$ mode would result in a limiting accelerator length of 10 to 20 ft. at 10.7 cm.

308 Phasing Properties of the Relativistic Resonance Accelerators. Part I. Synchrotron. Part II. Cyclotron with Varying Frequency of Dee Voltage (Phasotron), by M. Rabinovich. Journal of Physics U.S.S.R. 10, p. 523-529, 530-532, 1946.

The method of finite differences is used to investigate the phasing properties of the synchrotron; the fundamental phasing equation is derived; and the general stationary solutions of the equation and its stability are given. The phasing properties of the accelerator are not disturbed by the radiation of the electrons. A formula is given for the maximum energy attainable in the synchrotron.

The fundamental equation of phasing for the phasotron is derived and the law of variation of frequency in the stationary case is given. The stability of the stationary solution is considered. The problem of the phasing and of the beam intensity in relativistic resonance accelerators is reduced to the problem of a pendulum with large amplitude and slowly varying parameters and external momentum.

PHYSICS, GENERAL

309 Motion of an Ion in an Approximately Uniform Magnetic Field, by R. R. Dempster. AECD-2067, (RL 27.6.24), December 1, 1943, decl. June 23, 1948. 7 p. Document for sale by AEC. (Disposition as required for use in research, development, or manufacturing work)

The equations of the path of a charged particle in an approximately uniform magnetic field are derived.

310 On Physical Adsorption. Part IV. A Comparison of Two Theories of Multilayer Adsorption, by S. Ross. AECD-2076, n.d., decl. June 17, 1948. 35 p. Document for sale by AEC. (For publication in the Journal of Physical and Colloid Chemistry)

A new theory of multilayer adsorption published by G. F. Huttig is compared with the B.E.T. theory, using experimental isotherms, some already published and some never before published. The new theory is shown to describe the experimental results with greater precision. The difference in the postulated physical mechanisms of the two theories are pointed out. The basis for a modification, designed to provide a still more precise description of the experimental observations, is suggested.

311 Superlattice Presence in Cu_3Au and FeCo Systems, by S. Siegel and C. G. Shull. AECD-2077, n.d., decl. June 17, 1948. 5 p. Document for sale by AEC. (For publication in the Physical Review and for oral presentation at the June meeting of the American Physical Society)

X-ray diffraction techniques have been widely used in establishing the presence of superlattice structures for alloy systems. In a superlattice structure, the two atoms of a binary alloy occupy definite positions with respect to atoms of the companion species in contrast to the usual random substitutional location of one atom in the structure of the other. For instance, in disordered Cu_3Au the gold atoms are arrayed randomly at sites normally occupied by copper atoms in the copper lattice, but in ordered Cu_3Au all of the gold atoms are located at cube corners and copper atoms at face-centered positions of the unit-cell cube.

Cu_3Au was selected for initial study since superstructure effects are very pronounced for this alloy as is shown by extensive investigations using X-ray diffraction, resistivity measurement, and other techniques. X-ray diffraction measurements showed pronounced superstructure in the ordered sample, as evidenced by the presence of diffraction peaks at the (100), (110), (210), (211), etc., positions in contrast to their absence in the disordered sample. Samples of ordered and disordered FeCo were examined in the same fashion as Cu_3Au. Indirect measurements of electrical resistivity suggested strongly the presence of superstructure.

312 Electron and Nuclear Physics, by J. Barton Hoag. 3rd ed. revised by S. A. Korff. New York, Van Nostrand Co., 1948. 522 p.

This book deals with the electron, its charge and mass; wave-length and emission from hot and cold surfaces; and phenomena involving both the outer parts and the nuclei of the atom. Chapters on laboratory techniques are included.

PHYSICS, GENERAL

313 Electron Diffraction for Film and Surface Studies, by G. A. Doxey. Electronics, p. 112, June 1948.

Crystalline structures of thin films can be determined by diffraction patterns produced when electrons are directed through the material. Surfaces of the materials are studied by the patterns of the reflected electrons. Applications and equipment for the technique are described.

314 Electron Levels of Atoms Adsorbed on Crystal Surfaces, Part I, by F. F. Vol'kenshtein. Zhurnal Fizicheskoĭ Khimii 21, p. 1317-1334, November 1947.

The absorbed atoms and the lattice of the adsorbent were considered to be a single quantum mechanical system. Calculations were made for electron levels and corresponding wave functions. An investigation was made of the criteria of "physical" and "chemical" adsorption.

315 Identification of Beta-Rays with Atomic Electrons, by M. Goldhaber and Gertrude Scharff-Goldhaber. Physical Review 73, p. 1472, June 15, 1948.

An experiment was performed which led to the conclusion that β-rays, at the end of their paths, are identical to atomic electrons. The experiment was based upon the consideration that when β-rays are stopped in matter, their final fates depend on whether or not they are identical with atomic electrons. If they are not identical with atomic electrons, they would not obey Pauli's exclusion principle, and would be captured into bound orbits filled with atomic electrons. Their transition to the lowest orbit would be accompanied by emission of K x-rays longer in wave length than the K x-rays characteristic of the capturing atom because of the additional screening. The absence of these x-rays led to the conclusion that β-rays are identical with atomic electrons.

316 On the Kinetics of Electrons and Electromagnetic Fields, by Ye. A. Vaynrib and G. V. Spivak. Doklady Akademii Nauk SSSR 59, p. 663, February 1948.

317 Tables for Numerical Solution of Problems in Compressible Gas Flow With Energy Effects, by Ascher H. Shapiro and Gilbert M. Edelman. Journal of Applied Mechanics 15, p. 169-175, June 1948.

Tables of functions are given for solving problems in one-dimensional, compressible gas flow when energy effects, as represented by changes in stagnation temperature, are involved. The tables may be used for such typical processes as heat transfer at high gas speeds, combustion, moisture condensation shocks, flame fronts, and detonation waves. The Mach number is the independent argument of the tables, and there is one table for each of six specific-heat ratios, namely, 1.0, 1.1, 1.2, 1.3, 1.4, and 1.67.

QUANTUM MECHANICS

318 **Exclusion Principle and Quantum Mechanics**, by W. Pauli. London, H. K. Lewis and Co., 1948. 51 p.

319 **Pair Production by γ-Rays in the Field of an Electron**, by Vaclav Votruba. Physical Review 73, p. 1468, June 15, 1948.

The cross section $[\sigma(k)]$ for pair production by γ-rays in the field of an electron is calculated. This calculation is based on the Dirac theory of positrons as formulated in the quantum theory of wave fields and on the general expression for the matrix element H_{FA}^{III} which determines the probability of quantum processes of the third order.

320 **Resonance Reactions Involving Dirac-Type Incident Particles**, by G. Goertzel. Physical Review 73, p. 1463-1466, June 15, 1948. (See also MDDC-1352)

An investigation has been made to determine whether the results of Wigner and Eisenbud can be extended to include the scattering of a particle which obeys a Dirac-type equation. It is found that no additional difficulties arise as a result of the use of Dirac particles, and that the treatment of Wigner and Eisenbud can be carried through step by step with relatively minor changes. In order to carry out this program, however, it was necessary to determine the appropriate relativistic boundary conditions to be satisfied by the external and internal wave functions at the boundary of the internal region. It is hoped that a comparison of the relativistic and non-relativistic boundary conditions will lead to a clearer understanding of the boundary conditions in the non-relativistic problem.

321 **Two-Component Equation Arising from the Dirac Equation of the Electron**, by R. Becker. Nachrichten von der Gesellschaft der Wissenschaften zw Göttingen, p. 20-28, 1945.

Atomic Energy Commission declassified documents listed as available for sale may be obtained from:

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RADIATION SICKNESS

322 Effects of Deoxycorticosterone on Mice Irradiated with X-rays, by F. Ellinger. Proceedings of the Society for Experimental Biology and Medicine 64, p. 31-35. 1947.

Fatty changes in the liver brought on by irradiation of mice with LD_{50} of X-rays caused death. The percentage of mortality and liver damage was reduced to an extent proportional, within limits, to the dose of deoxycorticosterone administered. The toxic action of X-rays is due to the liberation of histamine like substances by tissue breakdown, since some histamine effects are known to be antagonised by deoxycorticosterone, while this substance has no effect on X-ray damage to the spleen and bone-marrow.

323 Prevention of Radiation Hemorrhage. Lancet 254, p. 489, March 27, 1948. (See also MDDC-1658, 1672)

Brief survey of the work done by Rekers and Field with the flavonol compound, rutin, in reducing excessive capillary fragility.

324 Stop Bleeding in Patients. Science News Letter 53, p. 196-197, March 27, 1948

This is a non-technical report on the development of toluidine blue and protamine sulfate for the control of hemorrhages induced by X-rays.

RADIOACTIVITY

325 Studies on the Radiation from Hf^{181}, by A.F. Voigt and B.J. Thamer. AECD-2083, n.d., decl. June 17, 1948. 8 p. Document for sale by AEC. (For oral presentation at a meeting of the American Physical Society)

An abstract of this document has previously been issued as AECD-1942 and listed in Abstracts of Declassified Documents.

326 Artificially Radioactive Se^{73} and Se^{75}, W.S. Cowart, M.L. Pool, D.A. McCown, and L. L. Woodward. Physical Review 73, p. 1454-1457, June 15, 1948.

A radioactive isotope of 7.1-hour half-life has been produced by alpha-particle bombardment of germanium. Assignment of the isotope is made to Se^{73}. Absorption measurements indicate the presence of a positron end point of 1.29 Mev. Aluminum x-ray absorption measurements indicate an x-ray emission with a mass absorption coefficient of 22.1 cm^2/g, corresponding to 1.17 A. Bombardment with alpha-particles of Ge^{70}, enriched electromagnetically from 21.1 per cent to 90 per cent, further confirms the assignment of the activity to Se^{73}. The half-life of Se^{75} is found to be 127 ± 2 days over a decay period of 1000 days. In this activity K-capture and gamma-radiations of 0.22 Mev and 0.43 Mev are observed.

RADIOACTIVITY

327 The Beta- and Gamma-Rays of Ga^{72}, by Allan C. G. Mitchell, Daniel J. Zaffarano, and Bernard D. Kern. Physical Review 73, p. 1414-1429, June 15, 1948.

The beta- and gamma-ray spectra of Ga^{72} (14.1 hours) have been measured in a magnetic lens spectrometer. Measurement of the energies of photoelectrons produced in a thin lead radiator gave lines corresponding to gamma-rays of energies 0.631, 0.835, 1.05, 2.18, and 2.50 Mev, and indications of weaker lines at 1.30, 1.47, 1.57, and 1.81 Mev. An internal conversion line, produced by a gamma-ray of 0.691-Mev energy, was also found. The beta-ray spectrum was found to be highly complex. It is possible to resolve the spectrum into seven groups with end-point energies at 3.17, 2.57, 1.74, 1.45, 1.00, 0.74, and 0.56 Mev.

328 The Emission of Alpha-Particles from Different Faces of a Radioactive Crystal, by K. B. Mather and F. N. D. Kurie. Physical Review 73, p. 1474, June 15, 1948.

Muhlestein, using a crystal of uranium nitrate, found differences between the numbers of α-particles emitted from the various faces to be as much as 15 per cent when using electrical counting methods and 32 per cent when counting scintillations. Using a crystal of $ThSO_4$ an examination of the rate of emission of α-particles from its several faces was made by the authors. From the data it appears that the observations of Muhlestein must have been somehow in error. The differences in the rates of emissivity determined for the several faces were within the limit of statistical errors.

329 Excitation Curves for the γ-Radiation from Light Elements Bombarded with α-Particles from Polonium, by Hilding Slätis. Nature 161, p. 899-900, June 5, 1948.

Using a polonium source of about 40 mc, the excitation functions of the γ-radiation from light elements bombarded with α-particles was observed. The energy of the α-particles used in bombarding was varied by means of carbon dioxide. Lithium, beryllium, boron, carbon, nitrogen, oxygen, fluorine, sodium, magnesium, aluminum, silicon, phosphorus, sulphur, chlorine, potassium, calcium and lead were investigated. γ-Emission was observed from lithium, beryllium, boron, nitrogen, fluorine, sodium, magnesium and aluminim. The intensity of the γ-radiation was measured as a function of the energy of the α-particles for all these except nitrogen. The α-particle threshold values for γ-emission and relative intensities (as percentage of the measured polonium γ-radiation background) of the γ-quanta were obtained.

The neutron-emission from beryllium was measured for α-particles of energies 4.3 and 5.3 Mev. The results and the statistical errors are plotted on an arbitrary scale.

RADIOACTIVITY

330 Investigation of the Spectra of the β-radiations of S^{35}, Rb ^{87}, and Ra D with the Screen-Cathode β-ray Spectrometer, by Ajit Jumar Saha. Proceedings of the National Institute of Sciences of India 12, p. 159 - 172, 1946.

Sulfur and rubidium were examined in the form of barium sulfate and rubidium chloride; Radium D(Pb^{210}) was extracted from a radon tube using the method of Lee and Libby. Curves are given showing the relation between beta counting rates and current for each of the three elements. A table is given summarizing the maxium energy of β-particles, the half-lives and the ft function (the product of half life and the expected half life according to Fermi's theory) for the elements studied. Using these ft functions the following Konopinski's group assignments were made: S^{35}, OB group; Rb^{87}, 2B group; Ra D, OC group. The possible existence of a metastable isomeric state of Radium E(Bi^{210}) with spin one is discussed. A schematic diagram is given of the screen cathode β-ray spectrometer and associated electrical circuits used in the investigation.

A Study of the Radiations from Iridium (194), Iridium (192), Lanthanum (140). Antimony (124), and Zirconium (95), by C. E. Mandeville and M. V. Scherb. Physical Review 73, p. 1434-1441, June 15, 1948.

The characteristic radiations of Ir^{194}, Ir^{192}, La^{140}, Sb^{124} and Zr^{95} have been investigated by absorption and coincidence methods. In all cases beta-gamma and gamma-gamma coincidence measurements were made. Energy values are given for the beta and gamma radiations of these radioisotopes. A disintegration scheme is given for Ir^{194}. Chemical purification was carried out for all the isotopes investigated except Sb^{124}.

The indices which appear in each number of Nuclear Science Abstracts will be cumulated for the semi-annual volume.

RADIOCHEMISTRY

332 The Effect of Radiation on the Physical Properties of Plastics, by J. G. Burr and W. M. Garrison. AECD-2078 (CC-1097; A-1487), December 6, 1943, decl. June 25, 1948. 32 p. (To be used informally in connection with research)

Changes in tensile strength and electrical resistivity as a result of β and γ irradiation are presented for 25 different plastics and synthetic rubbers. In certain cases, hardness and elasticity measurements are also given. It is shown that the rate as well as the total amount of radiation determines the resultant changes in physical properties. An attempt has been made to correlate the results in terms of the chemical and physical properties of the plastics.

Those plastics which can be used over a large thermal range are affected less with high-intensity radiation than those materials which have a low useful thermal range. Generally, plastics with a low initial specific resistance, i.e., 10^{10} - 10^{12} ohm-cm, show little relative change on irradiation. For plastics with high initial resistivity (i.e., $> 10^{14}$ ohm-cm), the effect of irradiation depends upon the amount and nature of added impurities. Those which contain the most impurity exhibit the greatest change in resistivity.

333 The Influence of Penetrating Radium Radiation on the Colloid-Chemical Properties of Starch Sols, by M. A. Khenokh. Zhurnal Obscheĭ Khimii 17, p. 1024-1029, 1947. (In Russian).

Sterile sols prepared with potato starch were irradiated through glass with 1000 mg of radium in the form of radium bromide. After 10 days of irradiation the relative viscosity had decreased 46%; however the rate of decrease dropped sharply thereafter. In 20 days the pH changed from 6.0 to 3.0. In 10 days the transparency increased from 33% to 85%, and at the end of 20 days it was 91%. There was a linear increase in reducing power with irradiation time over a period of 35 days. The irradiated sol gave the characteristic brown color of erythrodextrins. The author believes that irradiation ruptures some of the valence bonds of the starch molecule, and promotes oxidation of the decomposition products to acids.

334 Radiochemistry, Radiobiology, and Olfaction, by Bernard Duranton. Industrie de la Parfumerie 2, p. 196-198, 1947.

The author presents a theory which connects odors with the evolution of photons by permanently activated molecules.

RADIOGRAPHY

335 Stripping Film Techniques for Histological Autoradiographs, by G. A. Boyd and A. I. Williams. AECD-2066 (UR-29), May 20, 1948, decl. June 11, 1948. 18 p. Document for sale by AEC. (For publication in the Proceedings of the Society for Experimental Biology and Medicine)

Techniques are described for using stripping film NTB emulsions for studying alphagraphs of blood smears, identifying histological bodies containing aggregates of alpha-emitting elements, and preparing betagraphs without emulsion staining.

RADIOGRAPHY

336 Radioautograph Technique With C^{14}, by A. M. MacDonald, Jock Cobb, and A. K. Solomon. Science 107, p. 550-552, May 21, 1948.

A method for taking radioautographs with C^{14} is described which provides the intimate contact required between tissue section and film and makes it possible to develop the film and stain the section while they are in contact. Normal histochemical procedures can be used on a tissue section either before or after the radioautograph has been taken. Three examples of radioautographs taken with this technique are shown.

337 Radioautography; Some Physical and Radiobiological Aspects of the Technique as Applied to Thin Specimens, by L. D. Marinelli and R. F. Hill. American Journal of Roentgenology and Radium Therapy 59, p. 396-403, March 1948.

A simple method has been described whereby the uncertainty in exposure time for the production of satisfactory radioautographs is reduced. The graphs correlating activity of tissue section and exposure time necessary to obtain satisfactory results are presented for I^{131} and P^{32}. An estimate of the radiation dose delivered to tissue shows that the use of the fastest films is indicated, and that in general the radioautographic technique with thin tissue sections should be limited to patients undergoing therapy with radioelements.

338 Radiography in Modern Industry. Rochester, N. Y., Eastman Kodak Company, 1947. 122 p.

339 Resolution Testing in Autoradiography, by G. W. W. Stevens. Nature 161, p. 432-433, March 20, 1948.

The resolution obtainable in autoradiographs has so far been estimated by the sharpness obtainable when photographic emulsions are exposed in contact with biological sections in which radioactive isotopes have been deposited by biochemical processes. The distribution of the radioactive isotope will vary from one specimen to another, and even successive sections from the same specimen will not be absolutely identical. Strict comparisons of the resolution given by different techniques or photographic emulsions are thus most difficult to make.

Preliminary tests showed that a photographic silver image on a material such as the Kodak Maximum Resolution plate could be converted successively to silver bromide and silver iodide and still give a line separation of 0.5μ. These reactions can therefore be used to give a deposit of I^{131} with any required distribution, thus forming a radioactive test chart. Such test charts could be employed for systematically estimating the relative importance of the various emulsion and geometrical factors influencing the resolution of autoradiographs. They might also be used for comparing the effect of electrons of varying energy given by different isotopes. Another possibility is the production of test charts made from microphotographic replicas of tissue sections to aid in the interpretation of autoradiographs made from biological material.

RADIOTHERAPY

340 Accuracy in Radon Work, by H. C. Webster. British Journal of Radiology 21, p. 186-188, April 1948.

A short account is given of the organization of the radon service in Queensland, Australia. Using a gold seed technique for both interstitial and external application of radon, and measuring all seed as a routine procedure, accuracy of dosage can be maintained at as high a level as factors outside the control of the radon laboratory will permit. A method of grouping seeds is described which reduces wastage to a minimum.

341 Alopecia Areata Treated with Thorium-X, by P. J. Freeny. Lancet 253, p. 506-508, 1947.

A series of 24 cases of alopecia areata, including 3 cases of total alopecia, were treated with monthly application of Th-X(Ra^{224}) in varnish, for periods ranging from a few weeks to a year. Of the 24 cases, 22 responded with satisfactory regrowth.

342 Applications of Radioactivity to Biology and Medicine, by A. Strohl. Journal de Radiologie et d'Electrologie 28, p. 393-397, 1947.

343 Artificially Radioactive Isotopes and Their Use in Biology and Medicine, by I. N. Berkhovskaya. Uspekhi Sovremennoĭ Biologii 23, March 1947. 20 p. (In Russian)

The author discusses the following subjects: artificial radioactivity, obtaining radioisotopes, the characteristic of radio isotopes, extraction and enrichment of radio isotopes, radio isotopes in an organism, observation of radio isotopes, principles of work with radio isotopes, use of radio isotopes with large and small radiation activity. Five pages of tables giving characteristics of various radio isotopes are included.

344 Betatron Fights Cancer. Science News Letter 53, p. 386, June 19, 1948.

Patients with deep-seated cancer of internal organs will be getting treatment with 20 times more powerful X-rays starting in 1949. The high energy 20,000,000 volt X-rays will come from the new betatron to be installed at the University of Illinois College of Medicine in Chicago. It is the world's first installation of a betatron for cancer treatment and research.

RADIOTHERAPY

345 Biological Basis of an Associated Action of Hormones and X-Rays on Cancerous Cells of Certain Glands under Hormonal Control, by A. Chamorro. Comptes Rendus des Seances de la Société Biologie 142, p. 3-4, January 1948. (In French).

A method is described for the treatment of cancer by a combination of hormones and X-rays. The epitheliomas that can benefit from this method are those of the mammary gland, prostate, thyroid, ovary, uterus, submaxillary, and hypophysis.

346 Cobalt for Cancer Tested. Science News Letter 53, p. 275, May 1, 1948.

This radioactive material is being tested at four institutions to determine standard dose for treatment. It will be a cheap and plentiful substitute for radium. Radioactive cobalt can be used in needles or tubes in the same way that radium is used for cancer treatment. It cannot be used in a colloidal form, as radioactive gold is now being used, because it has too long a half-life, 5.3 years.

347 The Development of Radiotherapy; A Review of 50 Years' Progress, by N. S. Finzi. British Journal of Radiology 21, p. 105-108, March 1948.

A review of events in the development of radiotherapy is given starting with the work done by Leopold Freund in November 1896. The invention of the cyclotron has opened up new methods and fresh possibilities in radiotherapy by neutrons. It has also made available artificial radioactive substances, not only for therapeutic purposes, but also for physiological and pharmacological research. Immediately before the recent war the discovery of a chain reaction in uranium opened up greater possibilities. This discovery was first applied to the manufacture of atomic bombs but, as by-products of the atomic pile, a large number of new radioactive substances have been and are being made; and some of these are of great medical value, both for radiotherapy and in tracer work.

348 Effects of Radioactive Sodium on Leukemia and Allied Diseases, Preliminary Report, by T. C. Evans, M. Lenz, C. P. Donlan, and M. J. LeMay. American Journal of Roentgenology and Radium Therapy 59, p. 469-481, April 1948.

Radiosodium, taken by mouth, in a suitable quanity and at appropriate intervals, is effective in reducing symptoms of chronic myelogenous leukemia, chronic lymphatic leukemia and polycythemia vera. The rate of response to each treatment appears to be intermediate between that of roentgen therapy and treatment with radiophosphorus. The contraindications are similar to those for other forms of radiation therapy. 18 references given.

RADIOTHERAPY

349 Progress of Cancer Research, by I. Hieger. Nature 161, p. 385-386, March 13, 1948.

The twenty-fourth annual report of the British Empire Cancer Campaign indicates that extensive research is being carried out on radiation therapy, on carcinogenesis, and on the biochemistry of cancer in the different centers of research supported by the Campaign. The increasing prominence of physics in cancer research is chiefly due to developments in the technique and theory of radiotherapy, in the use of radioactive isotopes, in the field of microscopy and in the application of physical chemistry to the study of carcinogens. A brief summary of cancer research supported by the Campaign is also included.

350 Radioactive Isotopes. Ars Medici 3, p. 299-300, April 15, 1948. (In French).

The use of radioactive isotopes in the treatment of blood and neoplastic diseases are discussed. Radiophosphorus was the first radioactive isotope utilized in medicine. It can be administered orally or intravenously, generally in the form of the phosphate. One half of the amount given is eliminated by the urine within the first six days. Elimination is less abundant in the presence of leukemia and polycythemia. With normal animals radioactive phosphorus is deposited principally in bone marrow and bone and also in the liver, spleen and lymphatic ganglions. It is absorbed in greater quantities by neoplastic tissues than by normal tissues and is held longer by white corpuscles than by red corpuscles. In one fourth of the polyglobulia patients treated with radioactive phosphorus successful results were obtained after a single injection of 3 to 7 millicuries. Complications to be expected are thrombopenia, leucopenia, and anemia. Radioactive phosphorus does not seem to influence Hodgkin's disease, lymphosarcoma, or reticulosarcoma.

Radioactive strontium is rapidly absorbed by bony tumors and is of interest in the study of fractures. Radioactive iron is used as a tracer element in the study of the metabolism of iron. Radioactive sodium has been used in the treatment of leukemia. Radioactive iodine is absorbed by the thyroid. Normally a fraction of it is eliminated in the urine, but in hyperthroidism this elimination is greatly reduced.

351 Radio-Isotopes for Local Treatment of Tumours. Lancet 254, p. 372-373, March 6, 1948.

Au^{198} is used in the local infiltration of tumour masses to provide localized radiations. Experience has shown that, provided the tumour is not too vascular or friable, the radioactive gold particles are retained in the tissues, and provide a localized radiation without disturbing surrounding tissues. The colloidal gold solution is injected into the mass through a long fine needle, as in local anaesthetic infiltration. The types of cases treated successfully are: Hodgkin's disease; fibrosarcomatous mass below the clavicle; raised subcutaneous lesions on the forehead; squamous-cell carcinoma. Failures could be traced to the radioactive gold not being retained in the tissue: Several attempts were made to infiltrate tumours of the female genital tract, but seepage from the tumours was gross, and insufficient radioactive material was left in the tissues. A metastatic malignant lesion in the scalp was infiltrated, but hardly any radioactivity was retained; later the tumour was found to have large wide blood-vessels by which presumably the radioactive particles were rapidly removed. To try to overcome this difficulty experiments are being made with a radioactive silver nitrate solution containing the isotope Ag^{111}, with the idea that the cauterising action of the silver salt will aid its retention. Ag^{111} is a pure beta-emitter and there are therefore difficulties in detecting its presence by external measuring apparatus. Ag^{108} and Ag^{110}, which have some gamma radiation, are too long-lived for safety.

RADIOTHERAPY

352 Recent Advances in Treatment of Lymphomas, Leukemias and Allied Disorders, by L. E. Graver. Bulletin of the New York Academy of Medicine 24, p. 3-25, 1948.

The author summarizes his own experience and that of other recent observers. Emphasis is placed on improvement in palliative results in Hodgkin's disease, lymphosarcoma and chronic lymphatic leukemia by early detection of local lesions and treatment with roentgen irradiation; use of nitrogen mustards in patients with generalized Hodgkin's disease; use of P^{32} in polycythemia and in chronic myeloid and lymphatic leukemia with minimal enlargement of spleen, liver, and nodes. The limited application of urethane in some cases of leukemia and of stilbamidine in multiple myeloma is briefly discussed. The cure of some cases of Hodgkin's disease and lymphosarcoma is considered a possibility. If these diseases have a unicentric origin, sufficiently early obliterative roentgen therapy or even radical surgery might prove curative. Considerable hope is also held for more specific attack on these disorders by means of further modifications in radioactive isotope therapy and by discovery of more effective chemical agents.

353 6-Year Clinical Evaluation of Radiophosphorus P^{32} (in Disease), by C. A. Doan, B. K. Wiseman, C. S. Wright, J. H. Geger, W. Myers, and J. W. Myers. Journal of Laboratory and Clinical Medicine 32, p. 943-969, 1947.

A critical review of 100 cases treated with P^{32} is given. The main success of P^{32} has been in polycythaemia sera, in which the clinical and haematologic features were well controlled. In leukaemias, P^{32} was sometimes a valuable adjunct to other therapy, but in Hodgkin's disease it was without value. Deep bone pain and primitus may be controlled in some cases.

354 Treatment of Graves' Disease with Radioactive Iodine, by E. M. Chapman. Western Journal of Surgery, Obstetrics and Gynecology 56, p. 1-64, January 1948.

Radioactive iodine is prepared by the nuclear bombardment of tellurium with deuterons in the cyclotron. The principal isotopes produced are I^{130} (half-life of twelve hours) and I^{131} (half-life of eight days). From observations in treating 45 patients with diffuse goiters and hyperthyroidism, Chapman believes that radioactive iodine with a half-life of twelve hours is an effective single therapeutic agent. Like other methods of therapy it has certain limitations. Its possible late toxic effects will have to be observed with the passage of time. Contraindications to its use seem to be pregnancy beyond the first month, and disease of the kidneys.

355 The Use of Radioactive Iodine in the Diagnosis and Treatment of Thyroid Diseases, by J. H. Means. Bulletin of the New York Academy of Medicine 24, p. 273-286, May 1948.

This paper is a review with a consideration of the following points: diagnostic uses of I^{131}, detection of ingested radioiodine by means of Geiger-Müller counters, autoradiographic techniques, therapeutic uses, and protections needed for workers.

RADIOTHERAPY

356 The Value of Platelet Counts in Radiotherapy, by W. M. Court Brown. British Journal of Radiology 21, p. 221-225, May 1948.

The effect of wide-field irradiation on the blood platelet level is described, and it is suggested that the blood platelet level is a more reliable indicator of the effect of radiation on the bone marrow than the total white cell count. By using the blood platelet level in this manner it is possible to avoid altogether the production of partial or permanent marrow failure. The use of the platelet level in the planning of treatment is described. The relationship between the development of petechial haemorrhages and radiation-induced thrombocytopenia is discussed.

RARE EARTHS

357 Preliminary Report on the Hydrolytic Behavior of Cerium (IV), by K. A. Kraus, R. W. Holmberg, and F. Nelson. AECD-2070, May 25, 1948, decl. June 4, 1948. 15 p. (For oral presentation before a meeting of the East Tennessee Section of the American Chemical Society, held June 5, 1948)

Two experimental methods of approach were selected: (1) Spectrophotometry of solutions of ammonium hexanitratocerate (HNC) in perchloric acid solutions of varying acidity and usually of constant ionic strength (μ) and (2) measurements of the pH changes on dissolution of known amounts of HNC in perchloric acid solutions of known concentration and sufficiently high ionic strength to avoid significant changes in the activity coefficients of the ions involved. Data obtained indicate that Ce(IV) is partially hydrolyzed even in rather concentrated perchloric acid solutions. It was found that the hydrolytic reactions of Ce(IV) in the acid range studied (ca 0.01 to 10 M $HClO_4$) are very complex and the various reactions have not yet been completely elucidated. The results are essentially qualitative, and should only be considered preliminary.

358 The Quantitative Spectrographic Analysis of the Rare Earth Elements. Part I. Determination of Samarium in Neodymium. Part II. Determination of Europium in Samarium, by Velmer A. Fassel and Harley A. Wilhelm. Journal of the Optical Society of America 38, p. 518-526, June 1948. (See also MDDC-1512)

Spectrographic methods applicable to the determination of small amounts of rare earth impurities in other rare earths are described. The specific examples discussed are the determination of samarium in neodymium and of europium in samarium. The procedures involve the high current d.c. arc excitation of rare earth oxide-graphite mixtures. Selected lines of the major rare earth constituent are used as internal standards. The experimental error of these methods is about 4 per cent. Studies on the variation of the analytical intensity ratio during excitation and the effect of large changes in arc current, per cent graphite, and weight of sample charge on the intensity ratio values are included.

SCIENTIFIC RESEARCH

359 Chatillon Fort, the Cradle of Atomic Energy in France, by J. Labeyrie. Atomes 3, p. 18-21, January 1948. (In French).

The first atomic pile in France is being built at Chatillon Fort. It will be a small "pilot" pile using heavy water as moderator. The author gives a summary of the principles of the pile and discusses research being carried on at Chatillon Fort.

360 The United States Atomic Energy Commission, by R. P. Johnson. Journal of Engineering Education, p. 440-445, March 1948.

Research in the Atomic Energy Commission is discussed. The term "Research" covers an abnormally large fraction of the Commission's business; several times as large as in a normal business enterprise such as the Bell Telephone System or DuPont. The major installations which are spread far and wide about the country are briefly described together with the development of nuclear reactors for producing useful power, and the Commission's activities in the field of basic research which is composed primarily of the nonprogrammatic type of research. Two main problems confronting the Commission are those of security and people to do the research, development, and engineering which must be done in the immediate future. (TDD)

Atomic Energy Commission declassified documents listed as available for sale may be obtained from:

Document Sales Agency
P. O. Box 62
Oak Ridge, Tennessee

TRACER APPLICATIONS

361 Certain Considerations in the Application of Isotopes to Medical Problems, by DeWitt Stetten, Jr. Bulletin of the New York Academy of Medicine 24, p. 300-307, May 1948.

The properties and availability of stable and radioactive isotopes are briefly considered. Methods of handling, hazards, and waste disposal in so far as radioactive isotopes are concerned are also discussed.

362 How to Buy and Use Isotopes. Modern Industry 15, p. 40-44, March 15, 1948.

The miscellaneous applications of isotopes in industry are described and illustrated. Ways of using the isotopes, their availability and cost are discussed.

363 The In Vitro Synthesis of Heme From Glycine by the Nucleated Red Blood Cell, by D. Shemin, I. M. London, and D. Rittenberg. Journal of Biological Chemistry 173, p. 799-800, April 1948.

It has been demonstrated, in both the rat and human, that glycine is specificially utilized for the synthesis of protoporphyrin of hemoglobin. To facilitate the investigation of the mechanism of porphyrin formation a biological in vitro system was sought. Since hemoglobin in the non-cleated mammalian red blood cell is normally produced prior to the loss of the nucleus, the ability of the nucleated red blood cell from the peripheral blood of the duck to synthesize heme in vitro was investigated. Incubation of red blood cells of the duck, either in whole blood or in saline, with glycine labeled with N^{15} leads to the formation of heme containing N^{15}. This demonstrates the utilization of glycine for the synthesis of heme in vitro.

This system affords a means to investigate the mechanisms of the synthesis of heme. In addition the use of this in vitro system is being extended to the investigation of protein and nucleic acid synthesis.

364 Isotopes and Their Application To Peacetime Use of Atomic Energy, by Paul Aebersold. Bulletin of Atomic Scientists 4, p. 151-158, May 1948.

Tracer work in medical research and therapy, and in agriculture and industry is briefly reviewed. Progress in developing new research techniques is reported.

365 Isotopes in Physiology, by L. Bugnard and M. Polonovski. Journal de Physiologie 40, Part 1, No. 1, p. 1A-49A, 1948. (In French)

This article is a review of work done on isotopes, particularly as applied to physiology. The following topics are discussed: elementary phases of atomic physics, separation and determination of stable

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isotopes, production and determination of radio-active isotopes, precautions to be observed in the use of radio-elements, principles and conditions of utilizing isotopes in biology, preparation of tracer molecules, immediate analysis of tissues (isolation of substance tagged), study of cellular permeability, absorption and distribution of a tracer element in the organism, metabolic movement of the molecules (tricarboxylic cycle, metabolism of fatty acids, glucidic metabolism, synthesis of peptides and proteins in vivo, chlorophyll photosynthesis, and mineral metabolism).

366 Metabolism Experiments with the Help of Isotopes, by Karl Bernhard. Schweizerische Apotheker-Zeitung 86, p. 157-162, 1948.

This paper reviews the use of isotopes in metabolism studies.

367 Parenteral Plasma Protein Maintains Nitrogen Equilibrium over Long Periods, by Roger Terry, William E. Sandrock, Robert E. Nye, Jr., and G. H. Whipple. Journal of Experimental Medicine 87, p. 547-559, June 1, 1948.

Using heavy nitrogen (N^{15}) to label lysine, it was possible to produce in the dog labeled plasma proteins, which in turn were given intravenously to a normal dog. This labeled plasma protein did not long remain in the circulation — about 50 per cent disappeared within 24 hours — but the disappearance did not subsequently continue at this rapid rate. It was not possible to determine the concentration of the lysine proteins in various organs because of high dilutions and limitations of heavy nitrogen analysis. Possibly radio-carbon labeled lysine may enable the study of the distribution of this amino acid in the body. Work along this line is in progress.

368 The Span of Life of the Red Blood Cell; A Resume, by Winifred Ashby. Journal of Hematology 3, p. 486-500, May 1948.

In this review article on the life span of the red blood cell, the author concludes that it is the approximate dimensions of 110 to 130 days under favorable conditions. One section discusses the work of Shemin and Rittenberg in determining the life span by togging the corpuscles with the isotope N^{15}.

369 A Study of the Conversion of Isotopic Nicotinic Acid to N^1-Methylnicotinamide by James M. Hundley and Howard W. Bond. Journal of Biological Chemistry 173, 513-516, April 1948.

Rats fed large amounts of carboxyl-labeled nicotinic acid excreted N^1-methylnicotinamide chloride which contained 95.7 per cent of the original concentration of C^{13}, indicating that nicotinic acid is a precursor for N^1-methylnicotinamide.

Under the conditions of this experiment, rats excreted little, if any, N^1- methylnicotinamide from sources other than the ingested nicotinic acid and the body stores.

TRACER APPLICATIONS

370 A Symposium on The Use of Isotopes in Biology and Medicine. Madison, University of Wisconsin Press. 1948. 445 p. (Addresses Delivered at an Institute Held at the University of Wisconsin from September 10 to September 13, 1947.)

The papers presented at this symposium included the following:

Isotopes in Biochemistry; Historical Background, by Hans T. Clarke.
Separation of Stable Isotopes, by Harold C. Urey.
The Preparation of Radioactive Isotopes, by Glenn T. Seaborg.
Recent Developments in the Availability of Isotopes, by Paul C. Aebersold.
The Detection of Stable Isotopes, by Alfred O. Nier.
Fundamental Principles of the Detection and Measurement of Radioactivity, by Charles D. Coryell.
Assay of Radioactive Isotopes in Biological Research, by Martin D. Kamen.
Preparation of Compounds Containing Isotopes, by Donald B. Melville.
Studies on the Metabolism of Proteins, by David B. Sprinson.
The Use of Isotopes in the Study of Intermediary Carbohydrate Metabolism, by Harland G. Wood.
The Intermediary Metabolism of Lipids, by Konrad Bloch.
Tracer Studies on the Metabolism of Mineral Elements with Radioactive Isotopes, by David M. Greenberg.
Application of Radioactive Iodine to Studies in Iodine Metabolism and Thyroid Function, by I. L. Chaikoff and A. Taurog.
Medical Application of Radioactive Tracers, by Joseph C. Hamilton.
Therapeutic Use of Radiophosphorus in Polycythemia Vera, Leukemia, and Allied Diseases, by Byron E. Hall.
Treatment of Thyroid Disease by Means of Radioactive Iodine, by Saul Hertz.
Health Hazards in the Use of Radioactive Isotopes, by William F. Bale.
Measures for the Protection of Property and Personnel, by James J. Nickson.
International Aspects of Atomic Energy, by Harold C. Urey.
Comments on the Development of Atomic Energy, by Farrington Daniels.

371 The Use of Isotopes in Medical Research, by J. H. Lawrence. Journal of the American Medical Association 134, p. 219-255, May 17, 1948.

Non-radioactive isotopes, such as N^{15} and C^{13}, and radioactive isotopes provide the investigator with a valuable method for metabolic studies. The several techniques that have been developed using isotopes as tracers in such studies are discussed. Radioactive isotopes may be used as a source of therapeutic irradiation in substitution for roentgen rays and radium. If compounds containing radioactive elements emitting radiations which traverse only short distances and which localize to a high degree in neoplastic tissue can be found, important advances may be made.

TRACER APPLICATIONS, RADIOACTIVE

372 **Concerning the Mechanism of the Mammalian Conversion of Tryptophane into Kynurenine, Kynurenic Acid, and Nicotinic Acid**, by C. Heidelberger, M. E. Gullberg, A. F. Morgan, and S. Lepkovsky. AECD-2069, (UCRL-112), May 26, 1948, decl. June 23, 1948. 5 p. Document for sale by AEC. (For publication in the Journal of Biological Chemistry).

dl-Tryptophane-β-C^{14} was administered to rabbits, dogs, and rats. The kynurenine and kynurenic acid, isolated from the urines were radioactive, the labeled carbon being the methylene carbon and the 3-position respectively. The N- methylnicotinamide was not radioactive, indicating that it was produced from tryptophane by some mechanism other than ring-closure to a quinoline derivative, followed by oxidation.

373 **C^{14} Tracer Studies in the Rearrangement of Unsymmetrical α-Diketones: Phenylglyoxal to Mandelic Acid**, by O. K. Neville. AECD-2075, n.d., decl. June 14, 1948. 14 p. Document for sale by AEC. (For publication in the Journal of the American Chemical Society).

Mandelic acid, labelled C^{14} in the α-position was obtained from similarly labelled phenylglyoxal on treatment with alkali, thus demonstrating that no rearrangement of the carbon skeleton occurs and consequently that the reaction proceeds by a shift of the aldehydic hydrogen atom. The similar reaction of α, α-dibromoacetophenone with aqueous alkali has also been shown to occur without rearrangement.

374 **Changes in Phosphate and Carbohydrate Metabolism in Shock**, by E. S. Goranson, J. E. Hamilton, and R. E. Haist. Journal of Biological Chemistry 174, p. 1-9, May 1948.

In the uninjured muscle of rats shocked by a clamping technique there was a decrease in glycogen concentration which was not prevented by insulin. The glycogen content of the damaged (anoxic) muscle was very low. The phosphocreatine (PC) and adenosine triphosphate (ATP) content of the damaged muscle fell as a result of the clamping procedure and remained low after the clamps were removed. Inorganic phosphorus was elevated in the damaged muscle and the P^{32} values were reduced in all phosphorus fractions. After removal of the clamps the inorganic phosphorus level decreased somewhat but was still above normal. The P^{32} values, while still low, were frequently slightly increased above the concentration found in the clamped animals. The PC and ATP content of the undamaged muscle of the shocked animals did not differ from that of the non-clamped controls but the PC values were less than those of the clamped animals. The P^{32} values for PC, ATP, and inorganic phosphorus appeared to be elevated by the clamping procedure.

Insulin was found to promote an increased incorporation of P^{32} in PC and ATP in normal fasted controls. This effect of insulin was less evident in the non-traumatized muscle of the shocked rats. A marked elevation in the blood inorganic phosphate in the shocked rats was associated with a reduction in the inorganic phosphate of the damaged muscles following removal of the clamps. It is concluded that the reduction in the blood sugar level, produced by insulin in shocked rats given glucose, is due in part at least to an increased breakdown of carbohydrate. It is concluded too that the depletion of high energy phosphorus is not an initiating factor in shock. The possible involvement of insulin in oxidative phosphorylations is discussed.

TRACER APPLICATIONS, RADIOACTIVE

375 Distribution Studies. Part XI, Isolation of Benzylpenicillin Containing Radioactive Sulfur, by Yoshio Sato, Guy T. Barry, and Lyman C. Craig. Journal of Biological Chemistry 174, p. 217-220, May 1948.

The amorphous crude penicillin obtained by extraction of a culture of the mold Penicillium Notatum grown in medium containing radioactive sulfur as sodium sulfate has been studied by the counter-current distribution process. Crystalline benzylpenicillin containing radioactive sulfur was readily isolated. Quantitative calculations could be made from the data.

376 Dye Locates Brain Tumor. Science News Letter 53, p. 357, June 5, 1948.

Fluorescein and its derivatives have an affinity for tumorous tissue. By means of a Geiger-Muller counter brain tumors have been detected in patients whose blood streams were injected with diiodo-fluorescein containing radioactive iodine.

377 The Effect of Dinitrophenol on the Incorporation of Alanine Labeled with Radioactive Carbon into the Proteins of Slices of Normal and Malignant Rat Liver, by Ivan D. Frantz, Jr., Paul C. Zamecnik, J. W. Reese, and Mary L. Stephenson. Journal of Biological Chemistry 174, p. 773-774, June 1948.

Previous studies have demonstrated that C^{14}-carboxyl-labeled alanine is incorporated into the proteins of surviving rat liver slices during incubation of the slices in a Krebs-Ringer-Phosphate medium to which is added tagged DL-alanine. Little or no incorporation occurs if the incubation is carried out in an atmosphere of nitrogen. In the present work, it has been found that addition of dinitrophenol to the above system inhibits the incorporation of alanine into protein in both normal and tumor tissue, while permitting oxygen consumption to continue. The suggestion emerges that synthesis of alanine peptide bonds depends on a source of energy-rich phosphate donors.

378 Les Isotopes Radioactifs en Biologie, by A. Strohl and M. Berger. Paris, Masson et Cie, 1946. 124 p. (In French)

A review of the tracer work and therapeutic applications of radioactive isotopes. Special emphasis is placed on thyroid therapy, blood chemistry, metabolism of sodium, potassium, and phosphorus, isotopes, and cellular permeability of ions. Excellent bibliography.

379 Measurement of Diffusion Coefficients in Liquids by Radioactive Tracers, by Andrew Gemant. Science 107, p. 622, June 11, 1948.

For the purpose of an investigation of hydrocarbon oils the writer has developed a method of measuring by means of radioactive tracers the diffusion coefficient in liquids. The activity is followed by a Geiger-Muller counter during the diffusion process. This is made possible by using a suitable thin, highly

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porous structure, containing the solvent, into which the solute diffuses from the solution which is located below the porous structure. The counter tube is placed on top of the latter. If the equations involved in the diffusion and radioactive absorption process and the effect on counts of the distance of a sample from the counter are known, the observed rate of increase of counts per minute can be evaluated in terms of the diffusion constant. A diffusion test takes about 2 hours to complete. Results on aqueous and organic solutions of uranyl nitrate have been obtained to date. A paper on this subject is in the course of preparation.

380 The Measurement of Post-Transfusion Survival of Preserved Stored Hyman Erythrocytes by Means of Two Isotopes of Radioactive Iron, by John G. Gibson, Joseph C. Aub, Robley D. Evans, Wendell C. Peacock, John W. Irvine, Jr. and Theodore Sack. Journal of Clinical Investigations 26, p. 704-714, 1947.

Two radioactive isotopes of iron were used to measure the post-transfusion survival of preserved stored hyman erythrocytes. Only intact circulating cells containing radioactive iron bound in the Hb molecule are detected. The determination of the recipient's pretransfusion circulating red cell volume by means of fresh group 0 cells tagged with Fe^{59} permits an accurate calculation of recipient post-transfusion red cell radioactivity level corresponding to 100% retention of transfused stored cells tagged with Fe^{55}. It is possible to measure the extent to which iron derived from non-viable transfused stored cells is reutilized in the synthesis of new Hb. A discussion is given of the destruction of the homologous cells of patients of group A and B by high anti-A or anti-B titer donor bloods of group 0.

381 Metallurgical Tracers and Naval Research, by Julius J. Harwood. Journal of the American Society of Naval Engineers 60, p. 49-63, February 1948.

The fundamental principles involved are discussed briefly. A brief outline is given of a number of metallurgical projects involving use of radioactive tracers, that are being worked on for the Navy at the Carnegie and Stevens Institutes of Technology.

382 Nucleic Acids Labelled with P^{32} and N^{15}, by J. N. Davidson and W. Raymond. Biochemical Journal 42, p. XIV, 1948. (Abstract of paper presented at Meeting of Biochemical Society).

Sodium phosphate containing P^{32} was administered to rats in doses of about 10 μc. per animal and the livers were removed 2-4 hours later. Cytoplasmic and nuclear material were separated and the nucleic acids isolated from each fraction. The phosphorus of the ribonucleic acid was more active than that in the deoxyribonucleic acid, the ratio of the specific activities being about 7:1. Similar results were obtained with rabbits. Brues, Tracy and Cohn obtained figures of this order, while even higher ratios were found by Hammarsten and Hevesy.

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In regenerating rat livers the activity of both types of nucleic acid was increased but especially that of the deoxyribonucleic acid, so that the ratio of the specific activities fell to between 2 and 3. In foetal liver the specific activity of the deoxyribonucleic acid frequently exceeded that of the ribonucleic acid.

When ammonium citrate containing 4.18 atom % excess N^{15} was fed to pigeons and rats in doses of 50 mg/day for 3 days, the ribonucleic acid isolated from the pigeon liver contained 0.048 atom % excess N^{15} and the deoxyribonucleic acid only 0.003 atom % excess. The figure from the uric acid excreted in the last 24 hours was 0.204 atom % excess N^{15}. The ribonucleic acid isolated from rat liver contained 0.053 atom % excess N^{15}, while the amount of excess N^{15} in the deoxyribonucleic acid was negligible.

383 Passage of Selenium Through the Mammary Glands of the White Rat and the Distribution of Selenium in the Milk Proteins after Subcutaneous Injection of Sodium Selenate, by Kenneth P. McConnell. Journal of Biological Chemistry 173, p. 653-657, April 1948.

It has been demonstrated that after subtoxic subcutaneous injections of selenium (radioactive) as sodium selenate, selenium passes through the mammary gland into the milk of the white rat. Further, it has been found that administered inorganic selenium was converted into organoselenium in the protein fraction of milk because approximately 54 per cent of the selenium present in the milk was in the casein fraction, while smaller amounts, namely 40 and 7 per cent, were in the albumin and globulin fractions, respectively.

384 The Permeability of the Human Placenta to Sodium in Normal and Abnormal Pregnancies and the Supply of Sodium to the Human Fetus as Determined With Radioactive Sodium, by L. Flexner, D. Cowie, L. Hellman, W. Wilde, and G. Vosburgh. American Journal of Obstetrics and Gynecology 55, p. 469-480, 1948.

By using radioactive sodium, measurements were made of the changes in rate of placental transfer per unit weight of placenta in normal pregnancies from the ninth week of gestation until term. An increase of permeability of about 70 times was observed in this period. The permeability of the human placenta to sodium is similar to that of other members of the hemochorial group. The rate of transfer was not affected by chronic hypertension and cardiac disease. The fetus received as much sodium at the twelfth week and 1100 times as much at the fortieth week as was incorporated into the growing tissues.

TRACER APPLICATIONS, RADIOACTIVE

385 Plasma Inorganic Iodide As a Homeostatic Regulator of Thyroid Functions, by J. Wolff and I. L. Chaikoff. Journal of Biological Chemistry 174, p. 555-564, June 1948.

Rats were injected with 10, 50, 100, 200, and 500 γ of iodine in the form of KI labeled with I^{131}. The radioactivity served as a measure of the amounts of injected I^{127} that entered the gland. So long as plasma iodine remained above 20 to 35 γ per cent, organic binding of the injected iodide in the gland was blocked. Organic binding of the newly accumulated iodine began to occur only when the level of plasma iodine fell below the critical range of 20 to 35 γ per cent. A homeostatic mechanism is postulated in which excessively high levels of plasma iodine inhibit formation of the hormone in the thyroid gland. This mechanism helps to explain the beneficial effect produced in patients suffering from thyrotoxicosis (Graves' disease) when large amounts of iodine are administered. While the organic binding of iodine is blocked, the gland is still able to concentrate iodine. The results presented here thus establish that the normal thyroid gland possesses a mechanism for concentrating iodine that does not depend upon its conversion to thyroxine and diiodotyrosine.

386 Radioactive Isotopes as Indicators in Biology, by J. Sacks. Chemical Reviews 42, p. 411-456, April 1948.

This is an extensive review article on the use of radioactive isotopes as tracers in metabolism studies. A critical analysis is made of the scope and limitations of tracer techniques. 291 references.

387 Radioactive Manganese, Iron, Cobalt, Copper, Zinc, and Strontium; a Selected Bibliography of Recent Literature with Special Reference to Biological and Medical Applications, by Morris C. Leikind and Mabel H. Eller. Washington, Library of Congress Science and Technology Project, 1948. 17 p. (TIP U807).

A bibliography consisting of 151 references. (TIP)

388 The Rate of Post-Transfusion Loss of Non-Viable Stored Human Erythrocytes and the Re-utilization of Hemoglobin-Derived Radioactive Iron, by John G. Gibson, Wendell C. Peacock, Robley D. Evans, Theodore Sack, and Joseph C. Aub. Journal of Clinical Investigations 26, p. 739-746, 1947.

Non-viable stored human erythrocytes are removed from the blood stream after transfusion quite rapidly, and the rate of removal varies inversely with the precentage survival of the transfused tagged cells. Non-viable cells are completely removed in 24 hours, at or above 80% survival. Loss of non-viable cells may continue into the second post-transfusion day below this survival level. The majority of non-viable cells are removed from the blood stream during the first two hours after transfusion at any survival level. A 70% retention of all transfused cells may be considered the lowest safe survival level. The bodily economy of Fe derived from the Hb of non-viable cells is such that the utilization is about 20 times that of equivalent amounts of Fe given orally.

TRACER APPLICATIONS, RADIOACTIVE

389 The Requirements of the Fatty Acid Oxidase Complex of Rat Liver, by A. L. Lehninger and E. P. Kennedy. Journal of Biological Chemistry 173, p. 753-771, April 1948.

Particulate material separated from rat liver homogenized in isotonic salt solutions, washed with saline, and then suspended in water showed no activity in the oxidation of fatty acids when supplemented with adenosine triphosphate, Mg^{++}, and phosphate buffer. When the material was suspended in saline instead, the preparations were highly active with the supplements named. However, the fatty acid oxidase activity of the water suspension of the particles could be completely restored in the presence of adenosine triphosphate, Mg^{++}, phosphate buffer, cytochrome c, neutral salts, or certain non-electrolytes such as sucrose, and catalytic amounts of malate or oxalacetate. The function of the inorganic phosphate was found to lie in its participation in coupled oxidative phosphorylation by the use of P^{32} as a tracer. The action of malate or oxalacetate has two distinct phases: one, to initiate the oxidation of octanoate to the stage of the 2-carbon intermediate, and the second, to cause the latter to enter into the Krebs cycle by forming tricarboxylic acid.

The function of the neutral salts in the fatty acid oxidase system appears to lie in the production of an enzymatically active "flocculated" form of the enzyme from an inactive "dispersed" form.

390 Studies in Iron Transportation and Metabolism. Part VI, Absorption of Radioactive Iron in Patients with Fever and with Anemias of Varied Etiology, by R. Dubach, S. T. E. Callender, and C. V. Moore. Journal of Hematology 3, p. 526-539, May 1948. (See also Guide to Published Research 3, Abstract 97).

The isotope technic for studying iron absorption has been extended to measure the unabsorbed isotope in feces as well as the amount synthesized into hemoglobin. The recovery of radioiron from feces was shown to be accurate within 10 per cent.

There was suggestive evidence to indicate that, with the one mg per kilogram dose employed, normal subjects may sometimes absorb more iron than is converted within a two week period into hemoglobin. Patients with fever, untreated pernicious anemia, and refractory anemia were shown to absorb more iron than they use for hemoglobin. Patients with hemolytic anemia may absorb more iron than can be recovered in the peripheral blood at any one time because isotopic hemoglobin is removed from the circulation at a rapid rate.

Except in afebrile patients with hypochromic anemia, acceptance of the per cent of a given dose of radioiron which appears in circulating hemoglobin as a measure of iron absorption must be made with caution. The theory that mucosal cells accept iron for absorption or block its assimilation provides the best known explanation for iron absorption; but patients with adequate iron stores may assimulate considerable quantities of the metal and the block must be regarded as relative.

391 Studies of the Metabolic Exchange of Cerebral Centers with the Aid of Artificial Radioactive Phosphorus (P^{32}), by Fritz Roeder. Zeitschrift für die Gesamte Neurologie and Psychiatrie 178, p. 288-344, 1945.

Inorganic phosphates containing radioactive P^{32} were injected intramuscularly into 15 dogs, 31 rabbits and 33 guinea pigs. After 72 hours in some cases (time was not given for other cases) the injected animals were sacrificed, and total phosphorus and P^{32} concentrations were determined for several areas in the brain, liver and muscle and in the blood. Specific activities, the ratio of P^{32} to total phosphorus, are reported.

TRACER APPLICATIONS, RADIOACTIVE

392 The Synthesis of Bacterial Viruses. Part II, the Origin of the Phosphorus Found in the Desoxyribonucleic Acids of the T_2 and T_4 Bacteriophages, by Seymour S. Cohen. Journal of Biological Chemistry 174, p. 295-303, May 1948.

The preparation and properties of bacterial lysates after multiple infection have been described. As a result certain isotope experiments requiring viral isolation could be performed. The distribution of the bacterial and viral components in these lysates has been studied. It has been found possible to recover in a purified concentrate of virus much of the P assimilated and the desoxyribonucleic acid (DNA) synthesized after infection. The newly synthesized DNA greatly exceeded the starting DNA of the bacterial culture. With P^{32} in the labeled host or labeled medium, the DNA of the virus has been found to be built in the main from the inorganic P of the medium. Ribonucleic acid was not a precursor in the synthesis of this DNA and was essentially inert in infected cells.

393 The Synthesis of Protein by Non-Proliferating Escherichia Coli, by Jacklyn B. Melchior, Margaret Mellody, and Irving M. Klotz. Journal of Biological Chemistry 174, p. 81-88, May 1948.

It has been demonstrated that washed cells of Escherichia coli incorporate methionine labeled with S^{35} into non-dialyzable molecules by an enzymatic reaction. This synthesis of protein occurs despite a net decrease in the number of cells present. Asparagine has been shown to increase the synthesis. Glycine exhibits a much smaller increase, and glucose causes a definite inhibition. Azide, cyanide, and fluoride inhibit protein synthesis markedly. Penicillin G shows a very small inhibition, insufficient to explain its striking effect on the growth of Escherichia coli at corresponding concentrations.

Sulfanilamide causes an inhibition of protein synthesis in this system to a degree approximately equal to its effect on growth. However, the addition of p-aminobenzoic acid does not reverse the inhibition of protein synthesis in saline suspensions contrary to its effect on growth in nutrient media. In fact p-aminobenzoic acid is itself inhibitory to protein synthesis in the non-growing system.

394 Tracer Experiments on the Mechanism of Glycine Fermentation by Diplococcus Glycinophilus, by H. A. Barker, B. E. Volcani, and B. P. Cardon. Journal of Biological Chemistry 173, p. 803-804, April 1948.

Glycine is decomposed anaerobically by Diplococcus glycinophilus under appropriate conditions according to the equation $4CH_2NH_2COOH + 2H_2O \rightarrow 4NH_3 + 3CH_3COOH + 2CO_2$. The mechanism of this fermentation has been investigated by the use of C^{14}-labeled glycine, carbon dioxide, and acetic acid. The data collected supported the following conclusions. (1) Approximately 75 per cent of the methyl carbon and 54 per cent of the carboxyl carbon of acetic acid are derived from the methylene carbon of glycine. (2) From 90 to 95 per cent of the carbon dioxide is derived from the carboxyl carbon of glycine, the remainder coming from the methylene carbon. This indicates that one of the main reactions in the fermentation is a condensation between 2 molecules of glycine, or derivatives thereof, through their methylene groups. The terminal carbon atoms of the resulting compound, possibly a C_4-dicarboxylic acid, are converted mainly to carbon dioxide, and the 2 central carbon atoms are oxidized to acetic acid. The low specific activity of the carbon dioxide formed from methylene-labeled glycine shows that a complete oxidation of glycine can occur only to a small extent. (3) At

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least 6 per cent of the methyl carbon and 38 per cent of the carboxyl carbon of acetate originate from carbon dioxide. A comparison of the specific activities of the acetate carboxyl carbon indicates that a direct reduction of glycine to acetic acid is not an important reaction. (4) Acetate is metabilized very slowly if at all. This eliminates the possibility that carbon dioxide fixation in this organism involves the reaction $CH_3COOH \xrightarrow{CO_2} CH_3COCOOH \xrightarrow{CO_2} COOHCH_2COCOOH \xrightarrow{6H} 2CH_3COOH$ which would result in a redistribution of the labeled carbon in acetic acid.

395 The Use of Radioactive Isotopes in Immunological Investigations, I. Precipitin Reaction with Ovovitellin Containing P^{32}, by G. E. Francis and A. Wormall. Biochemical Journal 42, p. 469-474, 1948.

Vitellin containing P^{32} prepared from eggs laid by hens injected with phosphates containing P^{32} has been used for immunological investigations. P^{32} determinations have been made on precipitates obtained in ordinary precipitin tests to determine the amount of antigen in vitellin-antivitellin precipitates. This isotopic tracer method, together with total-N determinations, will readily allow antigen/antibody ratios to be determined. Other possible uses of radio-isotopes for the study of immunochemistry are indicated. Lipovitellin-antivitellin precipitates contained a much higher ratio of phosphatide P^{32}/protein P^{32} than did the lipovitellin antigens. This preferential carrying down of phosphatide by the precipitate is specific, and it does not occur in precipitin reactions unrelated to vitellin, e.g. in the precipitation of human serum proteins by their antibodies.

396 Utilization of Acetate by Tobacco Leaves as Determined with C^{14}, by G. Krotkov and H. A. Barker. American Journal of Botany 35, p. 12-15, 1948.

C^{14} in a labeled acetate carboxyl group was converted by tobacco leaves into carbon dioxide, water soluble substances not volatile with steam, water soluble substances which could be precipitated with barium salts, substances soluble in 95% ethyl alcohol, and an ether insoluble residue. At room temperature and in the dark about 0.11 millimoles of labeled acetate disappeared from a 3.1 g. leaf in 22 hours.

TRANSURANIC ELEMENTS

397 Neptunium and Plutonium, by L. B. Ponizovskiy. Priroda, No. 4, April 1946. 4 p.

The author presents a non-technical account of the production and chemistry of the transuranic elements neptunium and plutonium. References are made to the Smyth Report.

URANIUM

398 Polarographic Method for the Quantitative Determination of Uranium in Atmospheric Dust, by H. F. Ballenger. AECD-2065 (RL 4.6.285), August 26, 1944, decl. June 18, 1948. 11 p. Document for sale by AEC. (Disposition as required for use in research, development, or manufacturing work).

The sample of dust is collected and deposited from a known volume of air using a high voltage electrostatic (Cottrell) precipitator in conjunction with an electric vacuum pump. The apparatus is set up in the locality to be sampled. Care must be taken that the equipment will not interfere with the normal work in the area. The depositing tube is removed and lined with Whatman No. 42 filter paper. At the end of the test, the filter paper is carefully transferred to an Erlenmeyer flask and taken to the laboratory for the chemical treatment and polarographic analysis. Detailed directions for chemical treatment and polarographic analysis are given. A modified Heyrovsky Polarograph Model XI is used.

399 Electrical and Thermal Properties of Uranium, by Hermann Ebert and Alfred Schulze. Metallfurschung 2, p. 46-49, 1947.

Certain electrical and thermal properties of uranium metal of varying purity were determined. Sample I contained 99.9% uranium, Sample II 99.5%, and Sample III was of undetermined purity. Impurities present were aluminium, beryllium, silicon, manganese, iron and copper. The specific electrical resistance, σ_{20}, expressed in 1 x 10^{-4} ohm—centimeters and the temperature coefficient, $\alpha_{20} \times 10^3$ were respectively: 0.29 and 2.18 for Sample I; 0.37 and 2.00 for Sample II; and 0.44 and 1.97 for Sample III. The thermoelectrical potential against pure copper and platinum was determined. Two determinations on Sample II gave dE/dt values of 4.3 and 6.0 microvolts per degree against copper, and 12 microvolts per degree against platinum. Thus uranium is in the same position as molybdenum in the thermoelectrical series. Density values obtained were as follows: Sample II, 18.32 g/cc; Sample III, 18.30 g/cc. Thermal expansion data, l/l_c, in mm/m for Sample II are as follows: 100°, 1.60; 200°, 3.25; 300°, 5.00; 400°, 6.85; 500°, 8.75.